APRIL 1985 · Volume 8 · Issue 4

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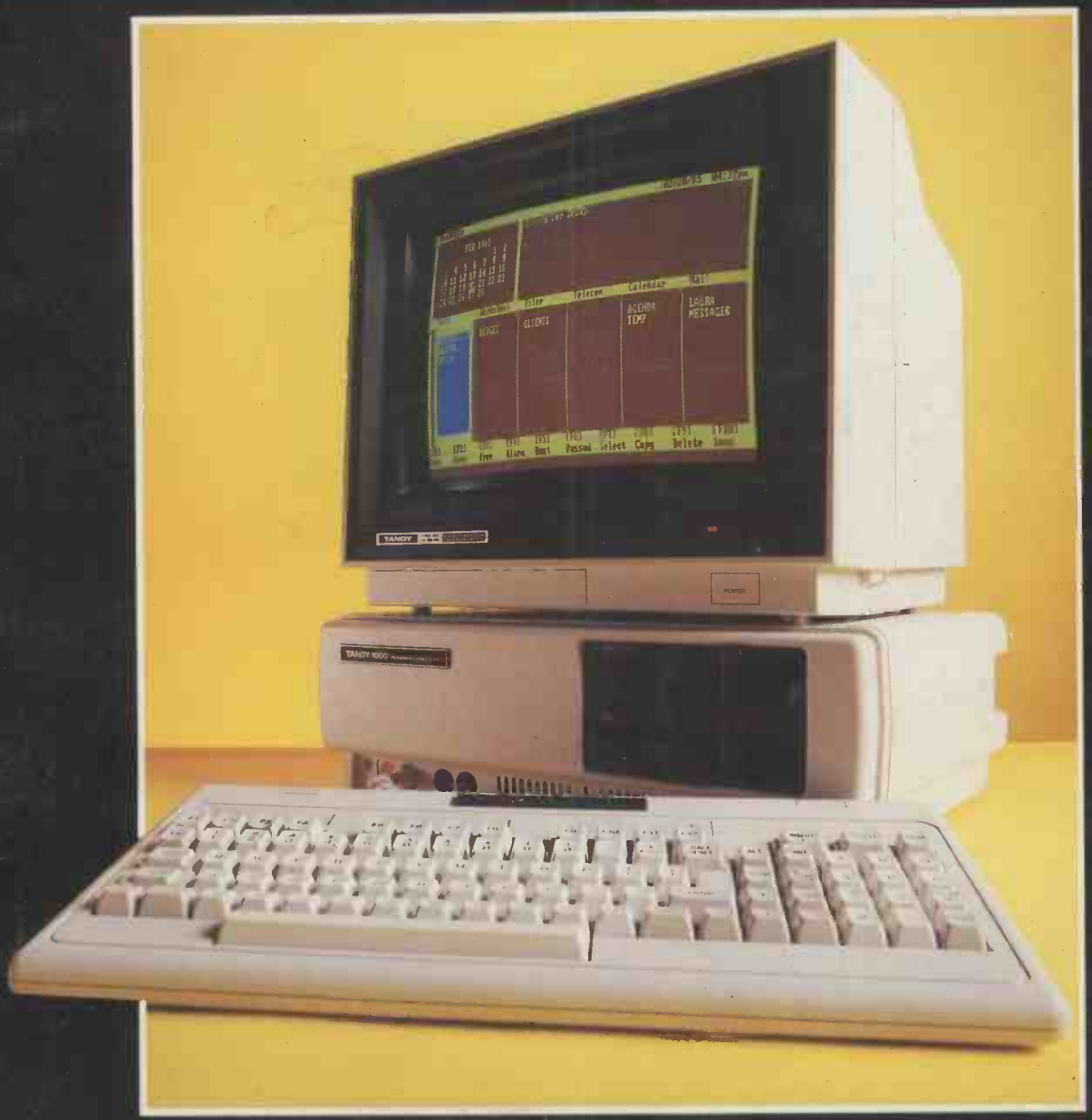

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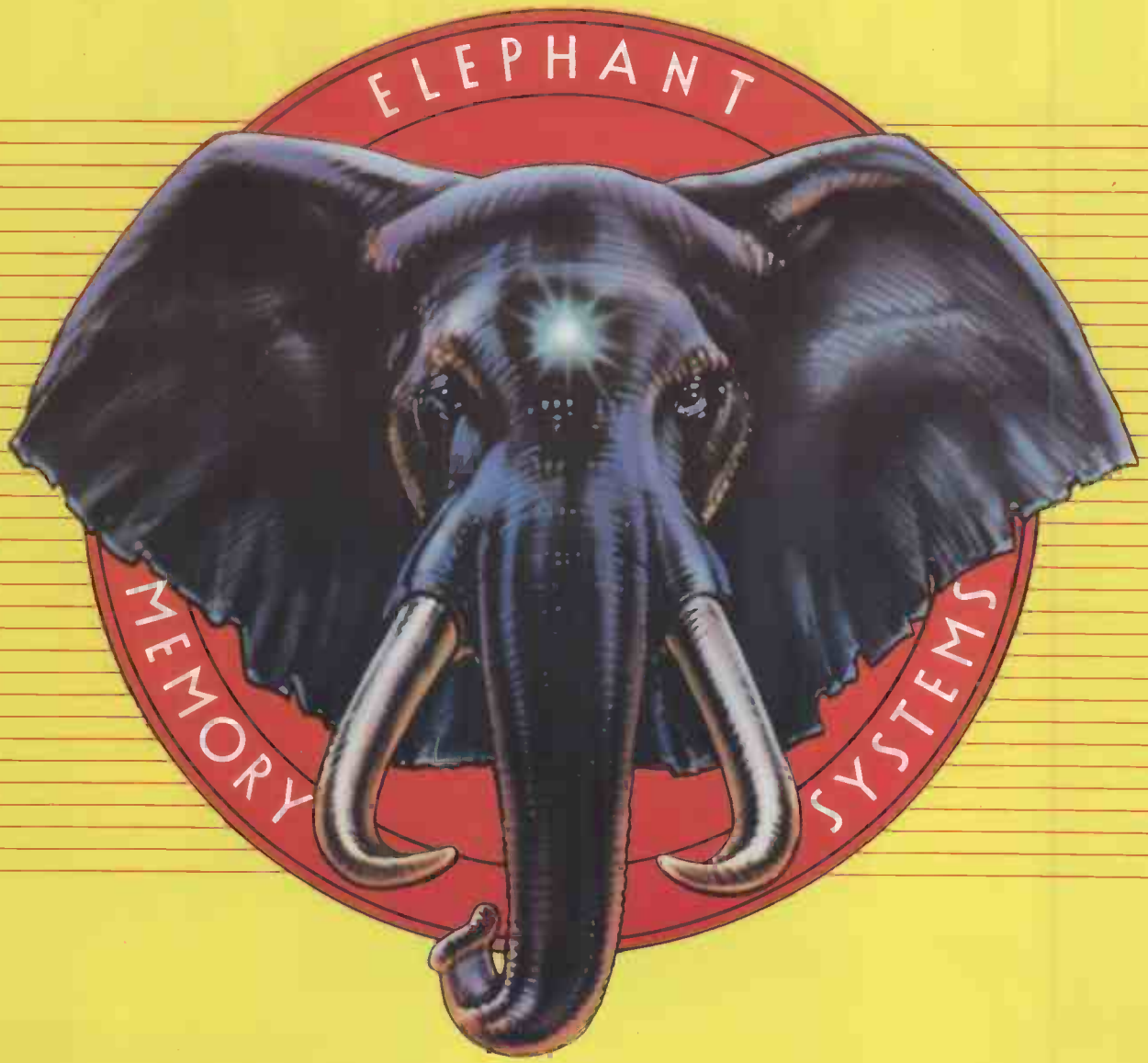

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Would-be authors are welcome to send articles to the Editor but *PC* cannot undertake to return them. Payment is at £35 per published page. Submissions should be typed or computer-printed and should include a tape or disc of any program.
Every effort is made to check articles and listings but *PC* cannot guarantee that programs will run and can accept no responsibility for any errors.

Ten years on

THIS YEAR the microcomputer is 10 years old. The world's first real micro — though billed as a "minicomputer kit" — was the MITS Altair which was launched as a do-it-yourself project in the American magazine *Popular Electronics*.

By current standards the Altair was a little lacking in most departments. It did not have a screen, a keyboard or a Basic, and it only had 256 bytes — not a misprint — of RAM. What it did have was Intel's new $367 8080 microprocessor and some lights and switches on the front. It was programmed directly in machine code, one byte at a time, by flipping the switches to represent binary 1s and 0s. The flickering lights were the output.

Of course, eventually the Altair acquired some powerful facilities. MITS's Ed Roberts hired a young lad called Bill Gates and his friend Paul Allen to write a Basic; it was supplied on punched paper tape but could be transferred to cassette. Then another young man, Intel employee Gary Kildall, wrote a disc operating system for the 8080; that was CP/M. Both were to become industry standards, as indeed did the Altair's system of construction, which lives on in the S-100 bus.

MITS's turnover hit a million dollars in its first year of computing, $3 million in the next, and was on course for $20 million in the third when it was taken over by Pertec. But by then a new kind of micro was becoming available: machines like the Apple, Commodore Pet and Tandy TRS-80 model 1. The companies that built them have grown to become billion-dollar corporations.

Software went through a similar development process. Word processing arrived with Electric Pencil in 1977, and the first spreadsheet with VisiCalc in 1979. Most of the programs were originally written by students — like the originators of VisiCalc — or hackers like the phone phreak Cap'n Crunch who wrote the Easy Writer word processor.

Now no one remembers that dBase II was going to be called Vulcan after Mr Spock in *Star Trek* — a programme which may have inspired the Altair name. Digital Research dropped the "Intergalactic" from its title. Kentucky Fried Computer changed its name to the much more sober North Star, and so on.

The process accelerated when IBM entered the micro market at the end of 1981 with its 16K cassette-based IBM PC. IBM's entry was seen as legitimising micros, dragging in its wake the other mini and mainframe manufacturers, Burroughs, DEC, Data General, Sperry, Xerox, etc.

Together the hackers and the corporations created the rich mixture that constitutes the micro market today, the one we know and love. The question is, what happens next?

There would seem to be three major threads in the way the microcomputer industry is developing. First, the IBM PC and its emulator are growing into powerful systems that integrate into corporate computing, as well as being suitable for personal use.

Second, there is the alternative user-friendly way of doing things, best exemplified by the Apple Macintosh, forthcoming Atari ST models and Digital Research's Gem environment. They aim to make personal computer power available to more people through the use of mice and icons.

Third, thanks to continuing falls in the price of technology there is the chance to have really useful computer systems at very low prices. For example, Amstrad's awaited CPC-664 could provide a 64K machine with built-in disc drive, 80-column monitor, CP/M and WordStar for under £500.

After 10 years we are coming to the end of an era: the time when computers were mainly bought either for education or just for fun. In the next 10 years, computer buyers will ask what everyone else has been asking all along: "Yes, but what can it do?" Companies that have a sensible answer will find buyers willing to pay more for useful systems, rather than buy cheap ones that end up gathering dust. Companies that do not have a sensible answer will go the way of MITS, Imsai, Sol, Ohio and other firms that once dominated the industry but now are almost forgotten. PC

5 Years ago...

A couple of times a week computing folk hold press conferences to announce some wonderful product. It is not seldom that they go like this: the managing director got up, got going and in five minutes had wound himself into a knot and crashed the system.

I got talking to the sales director and asked him how he proposed to sell his wonderful thing which cost a minimum of £50,000 a throw when it evidently didn't work, and moreover seemed to be up against a competitor which cost a fraction as much, and did work. "Ah", he said, his eyes glazed, his jaws chomping a morsel of smoked salmon, "that *is* an interesting question".

Afterwards, it seemed to us that they had done, badly, for half a million, what one of *PC*'s contributors has done on his kitchen table — properly — for £300. There seem to be two rules in software production:

- Expense is completely optional — the same thing can cost hundreds, thousands, tens of thousands or hundreds of thousands;
- The more it costs the less well it works.

PC Volume 3 Issue 4

SOME SEARCHING QUESTIONS TO ASK A DATABASE MANAGER

Now that microcomputers are capable of serious data storage, the hot phrase in software is 'database manager.' A good one, such as Superfile, turns a micro into a hyper-intelligent filing cabinet, combined with an amazingly deft assistant.

Any business that uses a card index or a filing cabinet would benefit from a database manager. It could do more for an enterprise than hiring a new executive – but it is necessary to be just as careful when interviewing candidates for the job. Vast sums of money are lost by companies investing in software that doesn't work hard enough. So it's vital to ask the right questions – and get the right answers.

"ARE YOU CAPABLE OF DOING A WORTHWHILE JOB?"

"You may do well with a small database, but how much can you store? How fast are you when full?"

Superfile's capacity is limited only by the hardware. The 8 bit version is fast, but the 16 bit version is lightning. On a suitable machine it can find one Record out of a hundred thousand in 3 seconds. A lot of main-frame computers would like to do as well.

"DO YOU KNOW THE FACTS OF LIFE?"

"In real life, everyone changes their minds about the structure of their databases. Can you adapt? Can you hold many different sorts of information at once? Can you find someone who says they're called 'Smith' when they're actually 'ssmythe'?"

Superfile has a completely flexible structure. A user can change the shape of Records after he has started to enter data. He can store as many different kinds of Record as he wants. Superfile also has a unique 'sounds-like' searching facility – very useful for anyone who deals face to face with the public.

"ARE YOU ECONOMIC?"

"Do you insist on storing everything in fixed length spaces, so that 'Mr Ho' takes up as much room on the disk as 'Miss Featherstonehaugh-Willoughby-Fanshawe-Tupman'?"

Superfile has variable length Records that can double or treble the useful space on your expensive disks.

"ARE YOU FRIENDLY?"

"Do your users need a PhD in computer science? Are your manuals as thick as telephone books and as tedious to read?"

Superfile's underlying concepts are simple to understand. Its screen Forms for data entry can be set up in minutes. Its paper Reports are equally straightforward. The manuals are slim and concise.

"ARE YOU MULTI-USER?"

"A database is vastly more useful if several people can consult it at once. Can you cope with many hands on your keys without hysterics?"

Superfile is available in single and multi-user versions. Very few others can make this claim.

"CAN YOU KEEP PACE WITH TECHNOLOGY?"

"Hardware is changing and improving so fast – can you keep up with improvements? Or will all my database work be wasted when I buy a new computer?"

Superfile will run on anything from small 8 bit machines to main-frames. Users' databases will just move across without trouble.

"WILL YOU BE FAITHFUL?"

"Will you take my money and run? If I have problems will you help?"

Superfile's publisher, Southdata, is a family business committed to good customer relations. When users buy Superfile, they can be sure of individual attention and full technical support.

Superfile is an advanced, British made package. It runs on most modern micros and is widely used, among others, by the Ministry of Defence and British Telecom – organisations that do not have to settle for second best. To find out more about Superfile and how it could become a powerful member of your company, just send the coupon.

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PC4

Preventing software piracy

THE UNCOPYABLE DISC is a complete non-starter in the stakes of software protection. Copy-busting utilities abound, rendering the whole concept useless, and the move towards hard discs renders them inappropriate. A licencing system which requires voluntary restraint by the end-user is a joke — it's like leaving a child unattended in a sweet shop.

That leaves the dongle as the only suitable alternative. The only drawback is that dongles cannot at present be stacked or chained together, so you have to fumble around the back of the machine trying to pull a delicately pinned dongle on and off. If you have more than two or three dongles this is not an enviable task and rapidly becomes responsible for 50 percent of the "my computer won't work" claims.

The solution to this problem is to stack dongles on a dongle tablet in the same way that carriages make up a train. Each tablet would hold half a dozen dongles with the facility to chain a second tablet on to the end of the first tablet. Each tablet would be on the end of a short fly lead, and hence easily accessible. All dongles would be on line at all times. The software simply checks that its dongle is present and ignores all the others.

The only remaining question is whether it be RS-232 or Centronics. Centronics would be better as the IBM PC has a Centronics port as standard — though unfortunately its pin-out is not standard. RS-232 is standard on nearly all computers but some IBM owners might have to buy another board.

If software houses would agree to a dongle standard then the current moans about software piracy would become a thing of the past. If the application software industry seriously wishes to claw back its £150 million of income lost to piracy then it should put its own house in order and not wait for politicians to do it for them. BSF and Dataview kindly take note.

Spencer Hall,
Accounting Software, Bristol.

Multi-column WordStar

IN YOUR January issue in "Feedback" in reply to R M Tobin you had said that you had no knowledge of software that could be used with WordStar to produce a multi-column printed text. Magic Bind by Computer Editype Systems of New York is just such a program.

It provides very good justification with proportional-spaced type, has many typesetting features, and the latest version includes mail-merge and address labels superior to many word-processsing programs. The program has been in use in this college for the past year and we have found it simple to use with no problems.

J M Chapman,
Principal,
West Kent College
of Further Education,
Tonbridge.

Benchmarks

I HOPE to help place in context the timings for the HP 200/16 noted by Boris Allan. Implementation of the Motorola 68000 CPU with 16-bit memory accesses at 8MHz must contribute to the high performance of the HP Series 200 machines. It seems likely that HP Basic 2.0 shares some of the features found in the Basic of the HP 85.

The HP 85's Basic allocates or partially pre-compiles programs when first run or initialised. Notably, within the structure of an allocated program:

- Numbers are stored in BCD, not ASCII format.
- All expressions are stored, stacked and evaluated using reverse-Polish notation.
- Variable names are replaced by two-byte offsets; these offsets yield absolute addresses when added to the base address of the variable table.
- Line-number references are transported into absolute addresses.

All of these techniques seem to imply optimisation of Basic for efficiency. I may have misinterpreted some of these characteristics and would be interested if anyone could move towards providing a more thorough analysis of efficiency of Basic and of factors affecting the performance of micros.

R J R Morris,
London SW5.

BORIS ALLAN is a writer who arouses strong passions in *Practical Computing*'s readers. Usually I dismiss the ire of his detractors and enjoy his well-turned ripostes, but this time it is I myself who feels he has written at length to little avail.

In his article "Speed Freaks" in February's issue Boris discusses, with much statistical reference, the meaning of Life, the Universe, and Benchmarks 7 and 8. He concludes — and I dispute it not for a moment — that BMs 1 to 7 are strongly correlated, forming a group of tests all of the same kind, but that BM8 is quite different.

Is this surprising? A cursory examination of BM1 to BM7 shows that they are indeed all much the same, and clearly belong to a group. Roughly speaking, in order they:

1. Do a For-Next loop.
2. Increment a variable and do a Goto,
3. As 2, and perform simple arithmetic with two variables.
4. As 3, but do the arithmetic with constants.
5. As 4, including a Gosub.
6. As both 5 and 1, together with dimensioning a numeric array.
7. As 6, including filling the array.

But what about BM8? Quite differently, effectively all it does is calculate powers and sine and log functions. The point is that the operations performed in BM1 to BM7 are built into the processor — with a little help from memory, the data and address buses, and so on. Those of BM8 are effected by the Basic.

Carrying out standard Basic commands like Goto and Gosub, and performing simple arithmetic, is primarily a hardware function, and the design of the software is relatively unimportant, though it may become the controlling factor when comparing machines with the same hardware. Powers, sines and logs, on the other hand, are usually calculated by summing appropriate series, and this is primarily organised by the maths package in the interpreter software, not by the hardware. You can therefore expect the results for BM1 to BM7 to be connected, and the result for BM8 to be quite unconnected.

To put things crudely, BM1 to BM7 indicate whether the chip designers knew their job, and to a lesser extent whether the machine's designers put it all together properly. BM8, on the other hand, shows the mettle of the writers of the system software, and whether they have chosen, and executed efficiently, the best algorithms for certain higher mathematical functions.

On one point I definitely

(continued on next page)

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek advice or make suggestions. Make sure you use Feedback — it is your chance to keep in touch. Write to:

Feedback, Practical Computing,
Quadrant House, The Quadrant,
Sutton, Surrey SM2 5AS

(continued from previous page)
agree with Boris: indiscriminate reference to the Benchmarks does not tell you which is the best all-round computer.

J P Lindesay,
Marlow,
Buckinghamshire.

● **Boris Allan replies:** My conclusion in the article was that BM1 to BM7 were all highly correlated, and one was almost as good as any other in discriminating between computers. BM7 was slightly more reliable because it took longer to run.

BM1 to BM7 do not reflect processor operations. To claim that the operations they perform are built into the processor assumes that it uses floating-point variables, that it has a For loop feature, or that it has a built-in Basic Goto.

If a 68000-series chip can perform arithmetic on 32-bit numbers, with hardware divide and multiply, then this has a tremendous effect on the speed of calculation of numerically intensive work, such as the calculation of series. For BM1 to BM7 the organisation of work is mainly controlled by the design of the Basic, but for BM8, using newer processors, the organisation of numerical work is simplified by the chip, and its calculation expedited.

What I find interesting is whether anybody ever checks the accuracy of the computations in BM8. That is a far more relevant and important test than a simple time trial.

Mr Men

WE AT MIRRORSOFT were delighted to see coverage given to our program Here and There with the Mr Men in your Early Learning feature in the February issue. However, two of the three screen shots credited to Here and There were in fact from our third Mr Men program Word Games with the Mr Men, which comes in a special double cassette pack for the 48K Spectrum and Commodore 64. The two which were mistakenly credited were those featuring Mr Funny, Mr Silly and Mr Noisy. The one featuring Mr Tickle is the Here and There shot.

Pat Bitton,
Mirrorsoft,
London EC1P 1DQ.

ABM

IN THE NEWS announcement on page 21 of your February issue, under the heading of "More Compatibles", the contact given is incorrect. The company is ABM Computers Ltd, 12 Holder Road, Unit F, Aldershot, Hampshire GU12 4RH. Telephone: (0252) 334282.

P Tucker,
ABM Computers Ltd,
Aldershot.

Network security

THERE IS a very simple protocol that would exclude hackers from computer networks using telephone system. After verifying the pass number, the host computer requests the user computer's phone number, which it verifies against a list of authorised numbers. The user computer then generates a large random number, which it sends to the host computer; the host computer also generates a random number, sends it to the user, and then rings off.

The host computer then dials the user computer and rechecks the pass number. The two computers then return the random numbers received in the first call, so that each computer should receive back the number it generated and sent during the first call. If the numbers tally, the link is opened.

This protocol has a further advantage. Anyone trying to access another computer has to give their own telephone number, and any computer linked to the system will be alerted if a hacker uses its code number. This will not make the system totally secure — nothing will do that — but it does mean that the criminal needs inside help to establish a password and phone number before gaining access to the system.

Peter Thomson,
Kendal,
Cumbria.

Amstrad Cat II

PETER PATON'S Cat II program for the Amstrad — January issue, page 158 — is most useful, but when I run it as listed the block number always prints as 1, even when Peek (47260) is greater than 1.

I think this fault must be due to an error in line 470, but as I do not understand the logic of this line I have left it alone and have altered line 600 to

```
PRINT "      ";PEEK(47260)
```

The program now works perfectly.

A J Snow,
Bushey,
Hertfordshire.

THERE APPEARS to be a small bug in Peter Paton's Cat II program whereby block number is always displayed as 1. If in line 470 a temporary variable is tested and documented instead of BN, then the bug I think is cured.

```
469 N = BN
470 IF N>1 THEN
    PLA = PLA – 2048:N = N – 1:
    GOTO 470
```

In experimenting with this program I found out the hard way about a pitfall lurking in the use of Break interrupt subroutines, invoked by the command On Break Gosub. While in a break interrupt subroutine, the Esc key appears to be disabled so that Break function itself is disabled; any On Break Gosub or On Break Stop commands issued in the break interrupt subroutine are effected, but only after Return from the subroutine.

Charlie Thomas,
London SW12.

Advance 86

BRIAN H WHALLEY is trying to set up a user group to provide information and share experiences, expertise and problems. His address is Wordscope, Cold Well House, Walwyn Road, Colwall, Malvern, Worcestershire WR13 6RL.

Enterprise Benchmarks

THE TIMINGS for BM1 and BM2 in last month's review of the Enterprise — page 73 — were printed incorrectly. The Enterprise may be slow, but not quite that slow. The true timings are
BM1 2.0 (not 24.0)
BM2 9.0 (not 19.0)
The Average value was shown correctly as 68.5.

Now available on Commodore IEEE.

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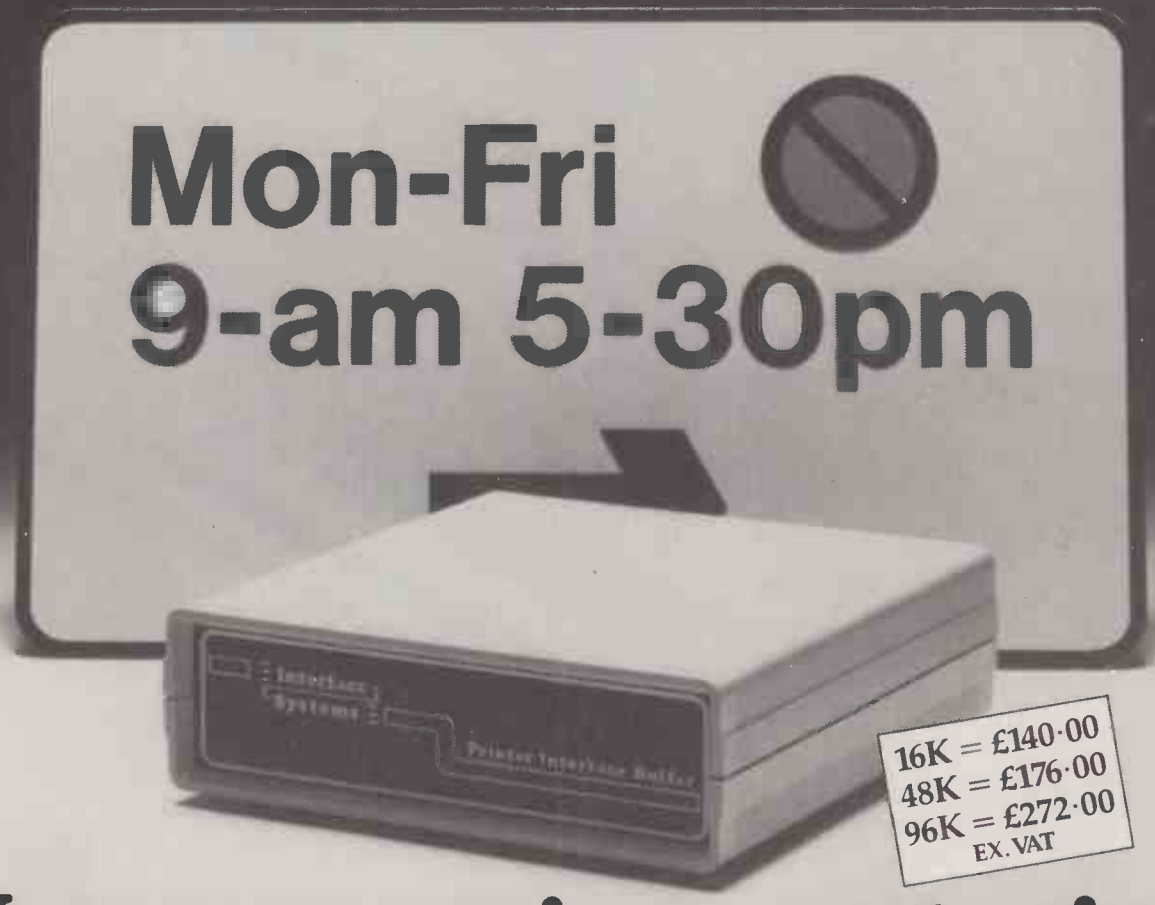

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Daisy wheel, letter quality, and bi-directional printing at a speed of 13 cps (Shannon text), 18 cps maximum, is the platform upon which Brother have developed the HR-15. Making it an attractive proposition to business people and hobbyists alike.

Take the daisy wheel itself.

Available in a host of typefaces, it comes encased in a protective cartridge.

As much to guard it from manhandling and prolong its useful life as to save you from dirtying your fingers.

A small point, perhaps, but it's indicative of just how far Brother go into the planning of their machines.

Simple but ingenious ideas like a ribbon cassette that snaps into place, plus a separate red ribbon.

Ingenuity that extends as far as a family of compatible accessories.

At the touch of a button, the HR-15 can be set to continuously print whatever is stored in its 3K buffer. Making form letters and document duplicates no problem at all. It also leaves your computer free for other operations. To clear the buffer for new text, all you do is re-press the same button.

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For those final touches that give your print-out that something extra, the HR-15 can print in two colours, shadow print and underline.

All carried out automatically during the print run, as instructed by your program.

Should that program be of a scientific or unusual nature, the HR-15 can take it in its stride. Fractions, exponential or any other characters that require specialised treatment are dealt with by its super and sub script facility.

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An impressive array of capabilities which is equalled by interface and DIP switch options, thereby extending the versatility of its operation.

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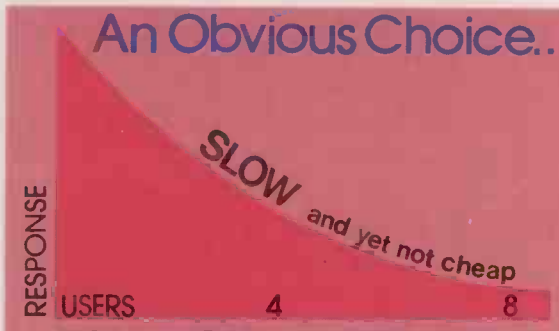
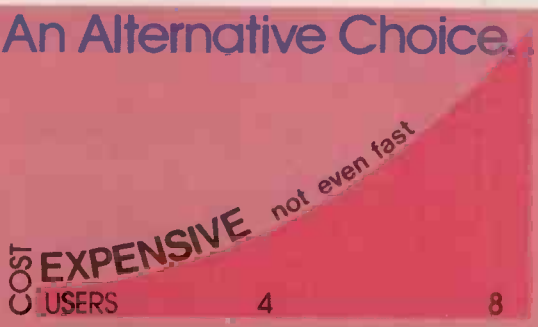


Time Sharing Micros

Typical multi-user micro machine are doomed by CPU degredation being based on time-sharing principles. Altos, Fortune and IBM PC/AT are in this class.

An Alternative Choice...



Networked PC's

Networks are too expensive and tedious. They do not offer a truly integrated multi-user system or speed. Networked IBM PC's and Apricot are such examples.

The Wise Choice...

Multi-Processing

The choice you didn't know you had . .

In Multi-processor SuperStar, each user has its own dedicated processor with up to 1Mbyte of RAM each, working at full CPU speed regardless of the number of terminals. The tremendous increase in power resulting from having up to sixteen 16-bit processors compared with time-sharing a single processor must be plain. Because it is a network on an internal bus, it is very much faster than conventional serial networks — yet it is much less expensive because all the processors are integrated into one desk- top unit instead of being distributed among the various PCs

SuperStar is a genuine multi-user system with record/file locking and with printer spooling. All MS-DOS and CP/M (all variants) programs run without modification. It is ideal for a cost-effective Office Automation system for any or all of the following functions in any combination.

- ★ *Word Processing and Spread-sheets*
- ★ *Database and Information Management*
- ★ *Telex, Electronic Mail and Communications*
- ★ *Genuine Multi-user Data Processing, such as Stock Control, Order Processing, and Integrated accounts.*

Rather than slow time-sharing micros or expensive networked PC's more and more companies are choosing multi-processing to meet their multi-user requirements, including:
BUPA*, BRITISH TELECOM, HILL SAMUEL*, MORI, PHILIPS*, MONSANTO, SOUTHAMPTON UNIVERSITY, BROMLEY HEALTH AUTHORITY, BANHAM ALARMS* AND MANY MORE.

*Case studies of their installations are available on request.

SuperStar is a trade mark of Bromley Computer Consultancy. CP/M is a trade mark of Digital Research. MS-DOS is a trade mark of MICROSOFT.

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12

● Circle No. 180

SuperStar-16 has a 16-bit Master Processor which runs IMPOS (BROMCOM designed true 16-bit controlling operating system) IMPOS supports CP/M, MS-DOS and shortly Xenix in slave processors in any combination and it is fully upward compatable with ACTION DPC/OS, Televideo MmmOST and TurboDOS

Feedback extra

One of the most insidious problems presented to programmers is where wrong answers are produced because of a failure to allow for the effects of rounding in calculations. The following letter is typical, and the problem is so important and so widespread we have asked John and Timothy Lee to deal with it in detail.

A question of accuracy

A NASTY bug comes with simple arithmetic in MBasic. Take the simple program

```
10 DEFDBL A,B,C,D
20 B = 9999: C = 123456:
   D = 0.0123456789
30 X = 9999: Y = 123456:
   Z = 0.0123456789
```

There are four ways of writing

A = 9999 * 9999 * 9999 * 9999

using all possible combinations A = C + D, A = C + Z, A = Y + D and A = Y + Z. Printing A gives three different answers.

Similarly, there are 16 ways of writing

A = 9999 * 9999 * 9999 * 9999

using all combinations of B and X; 12 ways give the correct answer. I defy anyone to predict which are the correct 12.

R G Silson,
Tring,
Hertfordshire.

● John and Timothy Lee reply: Any arithmetic operation, will be performed in the highest precision of the two numbers being processed. If both numbers are single precision, the sum is performed in single precision. If one or both is double precision, the sum is performed in double precision.

Mr Silson's observation that three different values of A are obtained can be explained theoretically. We have observed the theoretical results using six different versions of Microsoft Basic on different micros.

In the program shown in listing 1 the addition will be performed in the highest mode of either of the operands, so if both are double precision, the sum will be done in double precision. If one number is double precision and the other single precision then double precision will be used.

However, if both numbers are in single precision then the addition will be carried out in single precision and the least significant figures will be dropped in the addition. Even if the answer is then stored in a double-precision variable, it is too late. Only the seven most significant figures are kept and the least significant figures may be filled with any garbage that was there previously.

Listing 1.

```
10 DEFDBL A,B,C,D
20 C=123456: D=0.0123456789
30 Y=123456: Z=0.0123456789
40 PRINT "C+D both double precision"; C+D
50 A=C+D: PRINT A
60 PRINT "C+Z one double one single ie mixed mode"; C+Z
70 A=C+Z: PRINT A
80 PRINT "Y+D one single one double ie mixed mode"; Y+D
90 A=Y+D: PRINT A
100 PRINT
110 PRINT "Y+Z both single precision"; Y+Z
120 A=Y+Z: PRINT A
```

You might expect lines 40 to 90 to give the same accurate answer, and for lines 110 and 120, which are adding single-precision Y to single-precision Z, to give different rounded answers. This is not the case. The run produces

- C + D both double precision
  123456.0123456789
- 123456.0123456789
- C + Z one double one single, ie mixed mode
  123456.0123456791
- 123456.0123456791
- Y + D one single one double, ie mixed mode
  123456.0123456789
- 123456.0123456789
- Y + Z both single precision
  123456
- 123456.015625

As expected, C + D and Y + D are accurate, and Y + Z has been rounded. So why has C + Z yielded a slightly inaccurate result?

Z is a single-precision variable, and though line 30 sets Z to 0.0123456789 not all of these digits can be stored in single precision. Try adding

```
35 PRINT Z
```

to see what is really stored. It is the truncation at this stage that has produced the strange value for C + Z.

Mr Silson's second problem concerns the 16 different ways of writing

A = 9999 * 9999 * 9999 * 9999

The sum boils down to evaluating

B*B*B*B*

or

X*X*X*X,

and all the other combinations, as in listing 2. Remember the order in which arithmetic is performed.

Listing 2.

```
10  DEFDBL A,B
20  B=9999
30  X=9999
40  A=B*B*B*B: PRINT "B*B*B*B"; A
50  A=B*B*B*X: PRINT "B*B*B*X"; A
60  A=B*B*X*B: PRINT "B*B*X*B"; A
70  A=B*B*X*X: PRINT "B*B*X*X"; A
80  A=B*X*B*B: PRINT "B*X*B*B"; A
90  A=B*X*B*X: PRINT "B*X*B*X"; A
100 A=B*X*X*B: PRINT "B*X*X*B"; A
110 A=B*X*X*X: PRINT "B*X*X*X"; A
120 A=X*B*B*B: PRINT "X*B*B*B"; A
130 A=X*B*B*X: PRINT "X*B*B*X"; A
140 A=X*B*X*B: PRINT "X*B*X*B"; A
150 A=X*B*X*X: PRINT "X*B*X*X"; A
160 PRINT "LINES BELOW ALL HAVE
    SINGLE PRECISION STEP"
170 A=X*X*B*B: PRINT "X*X*B*B"; A
180 A=X*X*B*X: PRINT "X*X*B*X"; A
190 A=X*X*X*B: PRINT "X*X*X*B"; A
200 A=X*X*X*X: PRINT "X*X*X*X"; A
```

1. inside brackets
2. raising to powers
3. *,/
4. + , −

If there is more than one step possible at the same level of precedence then the calculation starts at the left and proceeds to the right.

Since X is a single-precision variable, the only time single-precision multiplication can occur with consequent rounding is if the line of arithmetic starts with X*X. . ., or X*X*X. ., or X*X*X*X. There are four such cases out of the 16, namely, X*X*B*B, X*X*B*X, X*X*X*B and X*X*X*X. These will give incorrect, rounded answers.

We would expect the first 12 results in listing 2 to be accurate, the next two identically inaccurate, and the final two different again.

Finally, there is no absolute guarantee that a compiler — particularly an optimising compiler — will do the arithmetic in the same order as described, so it may give different answers in mixed-mode arithmetic. PC

Apple assault

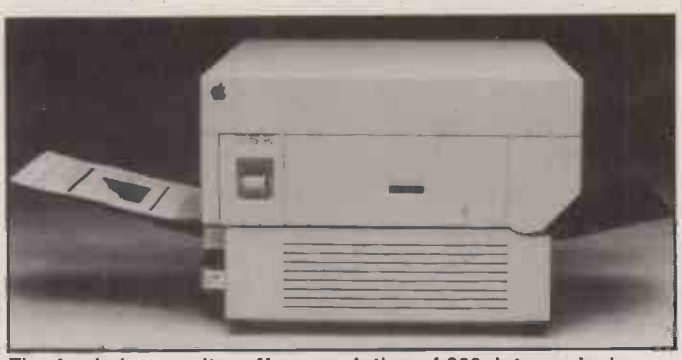
APPLE entered 1985 with annoucements of record sales and profit levels, two new products and a new name for an old friend. Sales for the first quarter of the fiscal year 1985 were nearly $700 million, an increase of 46 percent over the previous year's figure. Profits were up 50 percent to $46 million.

As part of its next assault on the corporate market, Apple has announced Appletalk for the Macintosh and related peripherals. This bus-type network allows up to 32 users to communicate over 1,000ft. A twisted-pair cable is used to carry the data at 230Kbit per second. Since most of the LAN hardware is already present in the Mac, installation costs are only $50 per connection. No U.K. price has been announced yet and first shipments are expected in June.

Appletalk controls traffic using the software protocol CSMA/CA, which stands for carrier-sense multiple access with collision avoidance. It is designed to allow all devices to compete equally for access to the cable. Under this system, a computer or peripheral which has data to transmit first tests whether the line is free or not. If a line is free, the device waits another 400ms. before reserving the line with a quick handshake process.

New products under development include hardware devices that connect Apples to IBM PCs, an Appletalk interface to the Ethernet LAN and gateways to IBM networks. All peripherals designed for use with the network will have most of the Appletalk architecture built-in.

The Laserwriter has already been released. It is a high-resolution laser printer, built around hardware from Canon like Hewlett-Packard's Laserjet discussed in last November's *Practical Computing*. The resolution is 300 dots per inch, and the throughput is up to eight pages per minutes. But whereas the Hewlett-Packard machine costs about £3,000, the Laserwriter costs nearly $7,000. The price differential is partly explained by the heavy processing power it contains. Apple even claims it to be its "most powerful computer". In addition to a 12MHz 68000, there is 512K RAM and 512K ROM.



The Apple Laserwriter offers resolution of 300 dots per inch.

Another new name from Apple proves not to be so new. The Macintosh XL is in fact the Lisa 2/10, which comes with 512K RAM and a 10Mbyte Winchester. The cost is £3,995. The old Lisa 2 and Lisa 2/5 will be phased out.

Finally, Apple has decided to make a bid for the U.K. education market in earnest. Under the banner of "Our Kids Can't Wait", Apple is offering a 50 percent discount on the Apple IIc and on Apple IIe machines fitted with one or two disc drives. Any number of the machines can be purchased.

Apple has a million machines installed in educational establishments worldwide, and is looking to oust Acorn now that the Government's funding scheme has ended. Apple states provocatively that its desire is "to make up lost ground caused by the use of the wrong machine in the past."

Apple can be contacted on (0442) 60244.

Macdrives

A RANGE of Winchesters and removable Winchester discs built by Tecmar is available from First Software. They all communicate with the Macintosh via the RS-422 port. An additional RS-422 port on the back on the Macdrive cabinet leaves the modem port free. Each unit contains a 68000 processor with 128K RAM which serves as a buffer.

In addition to ordinary hard discs there are removable versions. The 5Mbyte removable and 10Mbyte fixed discs cost £1,790, and the 10Mbyte fixed with 5Mbyte removable and the double 5Mbyte removable cost £2,990. More on (0256) 463344.

Modems keep coming

APPROVED MODEMS continue to arrive with decreasing prices. Telemod 1 operates at 300 baud and offers auto-answer. It also includes a built-in supply. The unit is produced by OE Limited on (0768) 66748.

The Answercall 100 Mini Modem from Answercall costs

£86.25 and also operates at 300 baud.

The Advanced Intelligent Modems from Timeplex offer a number of modems with speeds ranging from 300 baud to 2,400 baud. Costs start at £155. Timeplex is on (0423) 61317.

Crystalet

THE CRYSTALET from Aston Technology offers a one- to three-user system that is fully compatible with the range of larger Crystal machines. The new model offers a 68000 running at 10MHz, 256K RAM expandable up to 1Mbyte, four RS-232 ports, a 1Mbyte floppy and a 10.5Mbyte Winchester. Four operating systems and some 10 languages can be run. The cost starts at about £5,750. Telephone: 021-359 4861.

Channel 4 telesoftware

A TELESOFTWARE adaptor for use with the software which is broadcast on Channel 4's teletext has been produced by OE Limited. The unit currently only works with the Spectrum but there are plans to produce versions for the BBC and Commodore 64 in April and May respectively.

The unit allows you to not only view teletext information but to download the 10 alternating pages of software to be found on page 453 of the service. The cost is £125. More information on (0768) 66748.

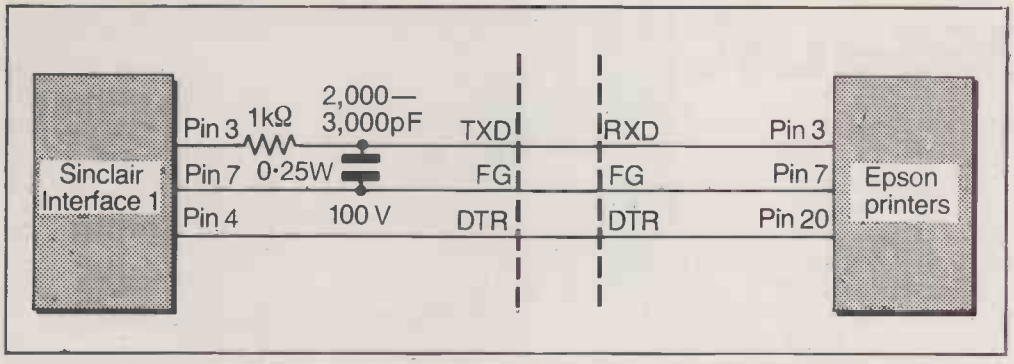
QL disc

WHILE the world holds its breath waiting for the range of Quest hard and floppy drives for the QL, Micro Peripherals has brought out its own. The 3.5in. system has a capacity of 720K. Up to four drives can be hooked up to the QL.

An interface module costing £99 is needed in order to use the

system. The first disc unit costs £189 and the second £159. A jumper on the interface can be set so that drives are accessed instead of the QL's Microdrives. Alternatively, they can be addressed as FDK_1 and FDK_2 from software. A 10Mbyte hard disc is expected to be ready in April. More information on (0256) 473232.

(more news on next page)



Interface 1

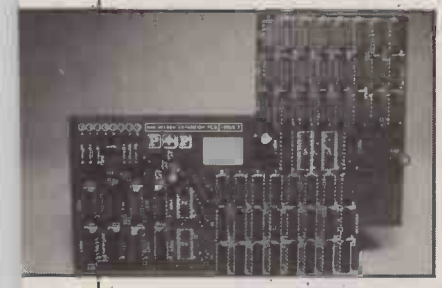
EPSON claims that the Sinclair Interface 1 may send out spikes on to the data line. This has caused the Epson printer to ignore any Escape codes which include CHR$27. Epson claims that this occurs mainly on the P-40 thermal printer and that it has also been a problem on MX, RX and FX printers.

Epson has suggested a slight modification which should avoid the problem — see circuit diagram above. For more details contact Epson on 01-902 8892.

Fatten up your Macs

P&P MICRO distributors is offering to upgrade a 128K Macintosh to the 512K Fat Mac for £499.50 plus VAT. This is over £300 cheaper than the official Apple price.

Since any warranty remaining is invalidated by such



an upgrade, P&P is itself offering to match the warranty, and add on an extra month up to a maximum of 13 months for new machines. Details on (0902) 43913.

HP family grows

HP has introduced the HP- 260 family aimed at the small business. The entry-level system, Model 15, comes with 256K RAM, a 15Mbyte Winchester and a 3.5in. floppy, together with one work station. The cost is £8,565. Up to 11 terminals and seven data-capture devices can be supported. For further details ring (03440) 773100.

Stride supermicros

THE STRIDE FAMILY of micros is produced by Sage, manufacturer of the Sage II and IV, which has now changed its name to Stride. The Stride 420 supports up to four users, the 440 up to 12 users and the 460 up to 22 users. The entry-level machine comes with a 68000 running at 12MHz, with 256K RAM and two 640K floppies. The price is about £3,400. The other two machines start at £6,000 and £9,000 respectively. Terminals cost around £500. More information can be obtained on 01-608 0818.

Spectrum disc drives

SPECTRUMS can be upgraded to something like a serious machine with new disc drives from Opus and Servicon. The Opus designs use 3.5in. discs with 256K unformatted capacity. A single drive unit costs £199.95 and will be sold only by Boots. Details on 01-701 8660.

The Servicon system uses a 2.8in. disc format with a capacity of 128K. The first disc-drive unit costs £129.95, the second £99.95. The interface contained in the first drive unit also provides an RS-423 socket and an RGB socket for colour monitor attachment. It is expected that the discs will cost about £2 each. More information on (0594) 542021.

Touch-screen BBC

THE MICROVITEC Touchtech 510 adds a touch-screen capability to BBC Micros using metal cabinet Microvitec colour monitors. The cost of £210 includes all the relevant software.

Like the Hewlett-Packard 150 — reviewed in *Practical Computing* in May 1984 — the screen hood uses a grid of infrared beams to determine the point touched. The information is fed back via an RS-423 connection to the BBC Micro. Later versions will use the RS-232 serial communications protocols.

Also included in the price is a series of demonstration programs which give an idea of some of the potential applications. More details on (0274) 390011.

Mains power from 12V battery

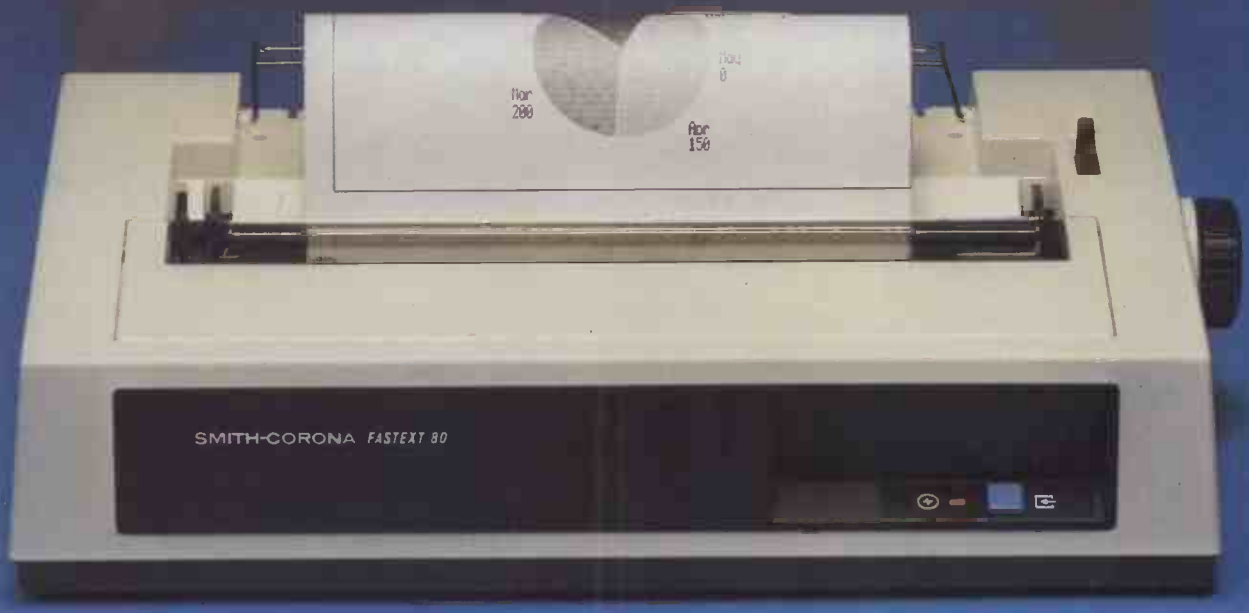
THE RME-100 inverter box lets you run mains-powered transportables like the Apricot, Kaypro or Macintosh from the batteries of a car or van. Developer Rayman Electronics claims that in typical use you can run your system for 20 hours before the car batteries start giving out. Two conventional wall-type three-pin output sockets are provided, so you can also run a printer.

The RME-100 costs £195 plus VAT. More details from Rayman Electronics, 42 Charlesworth Street, Bolsover, Chesterfield, Derbyshire. Telephone: (0623) 748129. PC

Hardware shorts

- Sinclair has dropped the price of its Microdrive cartridges from £4.95 to £1.99.
- Alpha Disc Ltd has produced the XF floppy which offers Apricot and IBM PC MS-DOS formats on an 800K disc. The cost is £395. More on (0784) 35357.
- Purchasers of the Brother EP-44 and TC-600 personal telecom terminals can join Telecom Gold for the special price of £19.95. Details on 061-330 6531.
- Prestel Education is a new service on Prestel page 888 aimed at schools and colleges. School membership is £49 a quarter and gives access to all the Prestel microcomputing services, including Micronet 800. More on 01-583 9811.
- MSX-Net is a closed user group on Telecom Gold for MSX users. Membership is £10 per year for home users. Recent additions to the service include access to The Source and Blaise. Details on 01-788 3583.
- TCS has produced a breakout box that allows various types of RS-232 connectors to be dealt with. Price is £45. More information on (0273) 778161.
- The Essex Forth Microcard offers a single-chip computer with a 4K Forth kernel, an RS-232 interface and 16K RAM. Cost is £119. Details on (0206) 865089.
- Victor Technologies has surfaced under its own name in the U.K. Its address is Unit 1, The Valley Centre, High Wycombe, Buckinghamshire HP13 6EQ. Telephone: (0494) 450661.
- OE Ltd has produced a communications package for the Commodore 64, allowing Prestel and Telecom Gold connections. The cost is £64.95. More on (0768) 66748.
- A Sharp MZ-700 club is being formed in the U.K. Membership costs £18. More information on (0905) 58351.

Join Forces



with Smith-Corona

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Link up with Smith-Corona now for the backing of their worldwide reputation and a nationwide dealer network. Make the first connection today—contact a distributor for a brochure and the name of your nearest Smith-Corona dealer.

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London-West: Millbank Computers Ltd., Millbank House, Arnyand Park Road, Twickenham. Tel: 01-891 4691.
Home Counties: Simnett Computers Ltd., Unit 14, St Georges Industrial Estate, 380 Richmond Road, Kingston-upon-Thames KT2 5PR. Tel: 01-541 1495. **Wiltshire:** Computercentre Ltd., Theatre Square, Swindon, Wilts SN4 4QN. Tel: 0793 694997. **South Wales:** Barbitan Ltd., 35-38 High Street, Bristol BS4 2AW. Tel: 0272-213928.
South West: CK Computer Supplies, Unit 8, Norside, Old Mixon Crescent, Weston-Super-Mare. Tel: 0934-418838.
Shropshire: Jentech Services Ltd., Smithfield Centre, Whitbury Street, Bridgnorth, Shrops. Tel: 07462-61458.
West Midlands: Daytron Ltd., Warwick House, Forge Lane, Minworth, Sutton Coldfield. Tel: 021-351 5959.
North East: Intac Data Systems Ltd., Frost House, Woodhouse Green, Thurcroft, Rotherham. Tel: 0709-547177.
Manchester: Mancos Computer Services, Unit 3, Albany Road Trading Estate, Manchester. Tel: 061-861 0757.
Merseyside: Rockcliff Microcomputers, 2 Rumford Street, Liverpool L2 8SZ. Tel: 051-227 2568.
Scotland: Chessbourne Ltd., 44 West Henderson Wynd, Dundee. Tel: 0382-29166.
Southern Ireland: TW Distributors Ltd., Frankfort, Dundrum, Dublin 4. Tel: 0001-728045.
Northern Ireland: Chessbourne Ltd., Hyde Park Industrial Estate, 17 Trench Road, Mullusk, Co. Antrim. Tel: 02313-43511.

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☐ further information on Smith-Corona printers
☐ the name of my nearest Smith-Corona dealer.

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17

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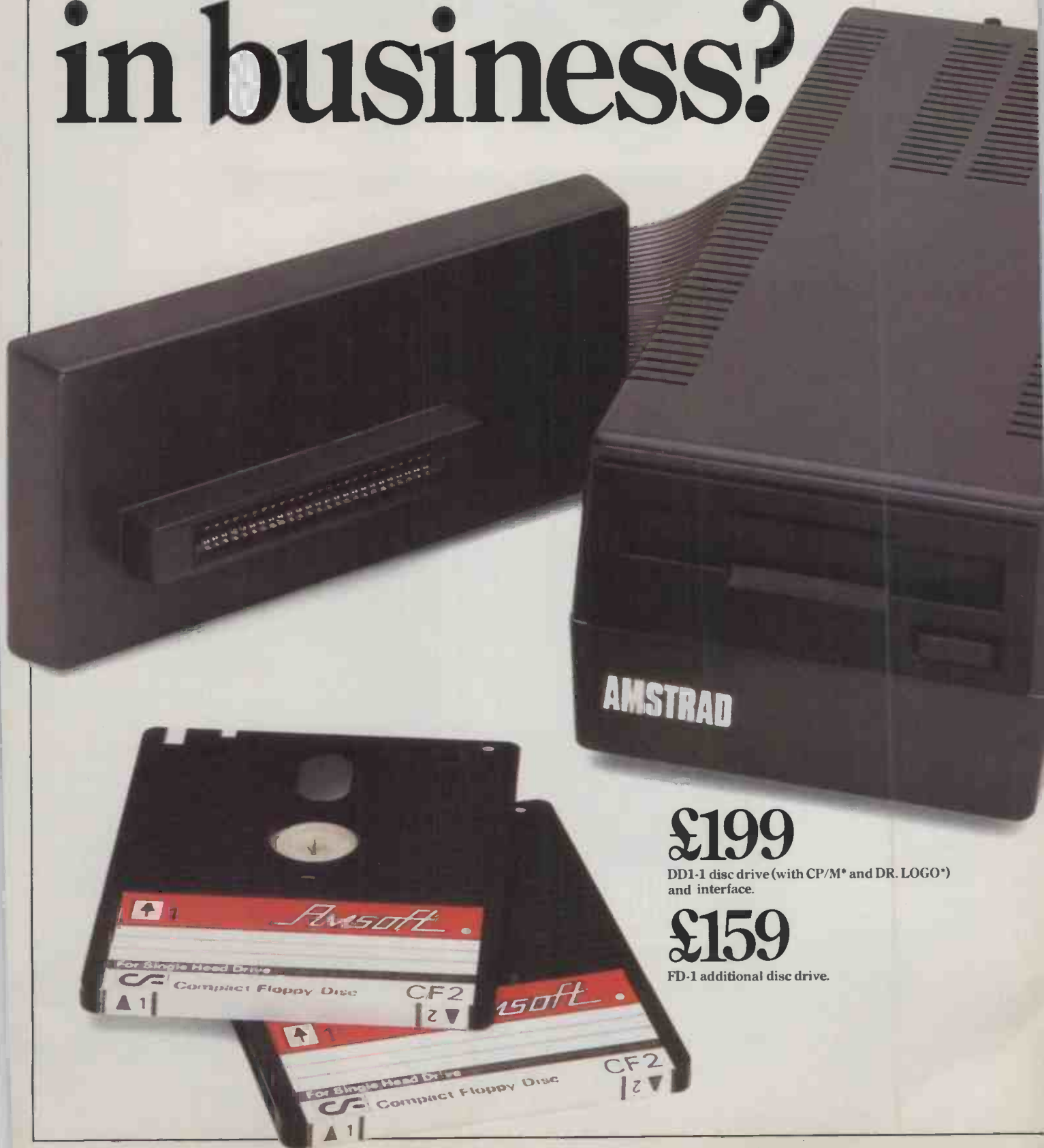
Have you got the drive to succeed in business?



£199

DD1-1 disc drive (with CP/M* and DR. LOGO*) and interface.

£159

FD-1 additional disc drive.

Running any business successfully means first running it efficiently.

And no matter how business-like you think you are, you can't beat the power and convenience of a random access CP/M* disc system.

Now, with Amstrad's CPC 464 computer, you can enjoy all the advantages of a 3" disc drive complete with an integral power supply and plug-in interface controller.

Naturally, you can add a second drive (FD-1) to double the on-line storage capacity, speed up copying files and producing back-up discs.

But of course, simply plugging a disc drive into a computer won't get you very far.

That's why Amsoft have produced a disc based software range of over 30 programs with many more on the way.

AMSDOS and CP/M.*

CP/M* is *the* standard disc operating system for 8-bit microcomputers.

We also supply a special version of DR. LOGO* for CPC 464 users.

Our disc drive system includes a number of extensions to BASIC in the AMSDOS operating system that allow the disc to use files originally created for cassette, and vice versa.

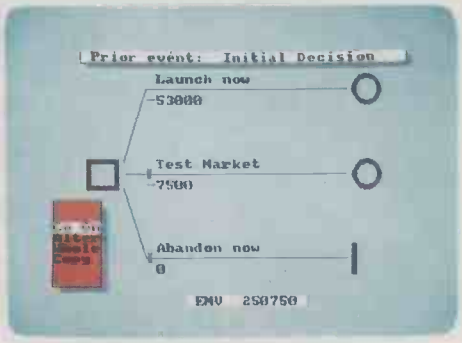
Software also takes care of the necessary file management so that CP/M* files can exist alongside these AMSDOS files.

Data files may even be shared between AMSDOS and CP/M.*

Word processing, data management, accounting, ledgers – you'll find an AMSOFT program to suit whatever kind of business you want to do on your CPC 464.

There's even a range of programs that teach you professional business practice.

Incidentally, you can exchange your Amsoft cassettes for identical Amsoft disc software for a mere £4.95 per cassette (the cost of a blank disc).



Decision Maker

CPC 464. Really gets down to business.

At the heart of it all, of course, is the incredible Amstrad CPC 464 computer.

The CPC 464 has a typewriter-style keyboard, large ENTRY key, sensibly positioned cursor keys, numeric keypad for fast data entry and a full 8-bit character set.

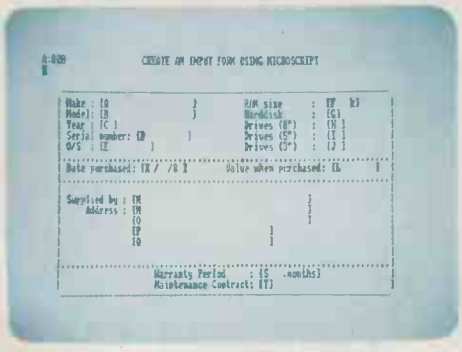
It provides high resolution graphics, 80 column text display, up to 8 text windows plus a graphics window and a palette of 27 colours.

There's also a built-in Centronics standard 7-bit parallel printer interface. So you can enjoy high performance word processing with the printer of your choice.

The CPC 464.

It does whatever you want it to do. But that, of course, is your business.

Optional 80 column dot matrix printer DMP-1. Operates at up to 50 characters per second.



Microscript

£239 complete with green screen VDU (GT64) and FREE software pack worth over £100.

£349 complete with colour monitor (CTM640) and FREE software pack worth over £100.

CPC 464 complete with monitor and datacorder

AMSTRAD

ONE GREAT IDEA AFTER ANOTHER

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*CP/M and DR. LOGO are Trade Marks of Digital Research

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PC 8

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Computers are like people.
They can learn from each other.
But first they have to communicate.
If your computer keeps itself to itself, why not introduce it to Sage Chit-Chat?

Chit-Chat is a versatile data communications program that can turn the most introverted computer into an outgoing conversationalist, in minutes.

By enabling your computer to communicate with other machines, Chit-Chat opens up a whole new range of possibilities for you. Data can easily be transferred, even between incompatible machines, either by cable if both are in the same building, or by telephone, using a modem. In this way, manual or automatic transfer of single or multi-files is possible between two machines, anywhere in the world.

Chit-Chat also gives you access to electronic mail systems, such as Telecom Gold and Easylink, which provide private and public mailbox facilities, plus worldwide telecommunications, telex and information management.

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Clever key utilities

THERE ARE now half a dozen fancy little utilities that enable you to customise your IBM keyboard and add macro facilities. Smartkey, Superkey, Quikey, Prokey and Keyswap are examples.

The idea of the packages is that they enable you to redefine the keyboard and make some of the more unusual characters readily accessible. Also, a whole sequence of keystrokes can be assigned to a single key. This macro facility enables many repetitive tasks, whether in word processing, data entry or programming, to be made semi-automatic.

First in the field was Rosesoft's Prokey. Version 2 arrived about 18 months ago, and version 3 late last year. It is available from Pete & Pam at £108 plus VAT.

Smartkey, from Software Research Technologies of Los Angeles, is the latest to reach the U.K. market, having been added to the Caxton Software range. It features a pop-up window so you can redefine keys while running other software. Caxton claims that over 30,000 characters can be assigned to a single key. Smartkey costs £79 plus £3 post and packing, plus VAT.

Contact Caxton Software, 10-14 Bedford Street, London WC2E 9HE. Telephone: 01-379 6502.

Borland International, which produced the useful Sidekick program, has now launched a $69.95 keyboard enhancer and macro programmer called Superkey in the U.S. Like Sidekick, it is RAM resident and claimed to be compatible with Prokey, but with added features including automatic recall, on-line help, cut and paste, and data encryption.

Automatic recall provides the facility to recall the last 20 commands, and to edit and reuse them. This is particularly valuable when working with PC-DOS. On-line help screens are provided via pull-down menus. Cut and paste means data can be taken from the screen, stored under a key, then moved into another application.

An extra function of the data-encryption module is to turn binary files into ASCII files. This enables them to be sent easily over the phone lines, after which the recipient can use the encryption key to decode them.

Contact Borland International, 4113 Scotts Valley Drive, Scotts Valley, Ca 95066, U.S. Telephone: (U.S. area code 408) 438-8400.

The U.K. supplier is likely to be Coquin Software, 14 Goodwood Close, Morden, Surrey SM4 5AW. Telephone: (0524) 381423.

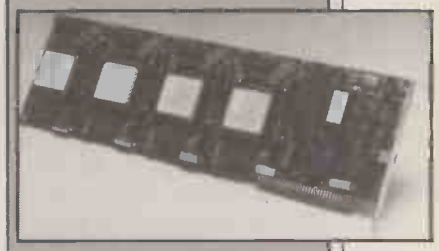
PC Automator is a new program that performs a similar task to Smartkey and Superkey, except it does this by providing a sort of enhancement to DOS. According to the distributor, the program "learns like a human operator by watching the keyboard and screen while the 'teacher' carries out the new procedures. It can be taught to make intelligent decisions, create help menus and ask and respond to questions, becoming in effect the 'perfect user'."

If it does all this it is probably a snip at £245 plus VAT. Contact Direct Technology, Grove House, 551 London Road, Isleworth, Middlesex TW7 4DS. Telephone: 01-847 1666.

IBM shorts

● Datatalk is a British communications package for the IBM PC and emulators. It uses colourful windows, offers help and has an autodial facility. The price of £135 plus VAT includes registration on Telecom Gold, One to One and Easylink. Phone Datasoft on (04605) 4809.

● Bubble memory is now available for the IBM PC in the form of the 512K XBIM



card. It is rugged, non-volatile and claimed to run eight times faster than a floppy disc. Phone Xcalibur on (0604) 21051/4.

● Options is a new business risk-analysis program from Sagesoft, which provides answers to What-If? questions transferred from a spreadsheet. It costs £145 plus VAT. Phone: 091-284 7077.

● IBM-style Basic is now available for the IBM PC. RM/Basic is the sort of language familiar from the System/23 and other large machines, not the Microsoft Basic which is standard on the PC. Phone Ryan-McFarland: (0992) 24981.

● Digital Research has announced DR Level II Cobol for PC-DOS. It meets full ANSI standards for high-level compilers, and costs £595. Phone (0635) 35304.

● Micro Status is a program to analyse traffic information from a PABX telephone switchboard. It costs £495, including a data-capture device. Contact Tiger Information Systems, Crown Court, Wimbourne, Dorset BH21 1LP.

● Olivetti has launched a 3274 emulator for the M-24. It comprises a plug-in board at £282, plus software: £403 for SNA, or £323 for BSC networks. Phone: 01-785 6666.

IBM results

TURNOVER rose 40 percent for IBM United Kingdom Holdings Ltd, according to provisional results for the year to December 1984. Sales in the U.K. were up by 26 percent, exports by 58 percent, and pre-tax profits by 27 percent. Turnover was £2.35 billion, with after-tax profits of £200 million.

During 1984, IBM invested £149 million in the U.K., and increased its staff by 1,380 to 17,506.

● LSI has developed a £199 plug-in board for its MS-DOS micro which detects IBM PC addresses and thus turns the Octopus into an IBM PC clone — except it is still claimed to run 50 percent faster than the IBM. The Octopus still has a Z-80 for running CP/M packages too. Phone: (04862) 23411.

Domino

COMPSOFT, best known for its Delta database, has launched a £495 training and presentation aid called Domino. The package is for the fast production of colour-graphics screens for display, teaching, market research and all types of questionnaire and test. A library of popular shapes and images is supplied.

Domino will accept multiple choice, text, numeric or date responses, and transfer the results to Delta for analysis. The package will aso generate reports.

Contact Compsoft plc, Compsoft Manor, Farncombe Hill, Godalming, Surrey GU7 2AR. Telephone: (04868) 25925.

(more news on page 25)

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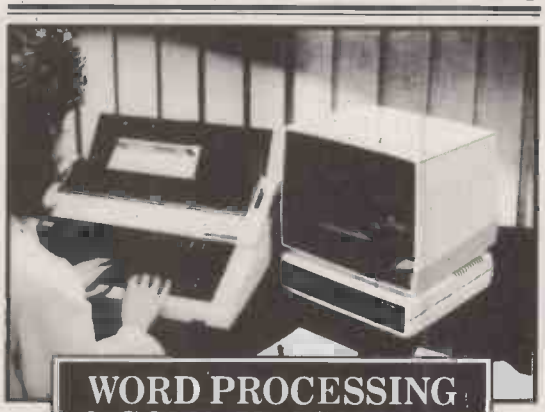

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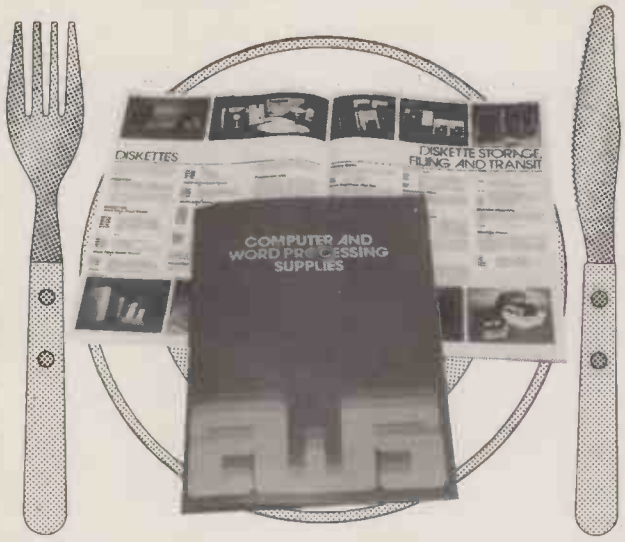

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Amos/PC

ALPHA MICRO has expanded its line of multi-user systems by putting Amos — Alpha Micro operating system — on to the IBM PC/XT and look-alikes.

The new £2,400 package consists of an AM-170 board with a Motorola 68000 CPU and 128K of RAM. Then by loading the copy of Amos supplied, the PC is turned into a three-user multi-tasking system.

Advantages of the system are that it is available now via 75 Alpha Micro dealers. Also, Alpha Micro has been selling multi-user systems since 1977 so there is already applications software available.

A further product is Alpha Micros ELS twin-processor micro. This is an Alpha Micro system with 10Mbyte hard disc, 360K floppy and two processors. There is a 68000 with 128K of RAM to provide a three-user Amos system. There is an Intel 8088 with 256K of RAM to provide a single-user MS-DOS system.

At the moment MS-DOS and Amos cannot be run at the same time. However, text files can be interchanged between the two. ELS users can later upgrade to, say, 40-user Alpha Micro systems.

Contact: Alpha Microsystems (G.B.) Ltd, Berkshire House, 56 Herschel Street, Slough, Berkshire SL1 1PY. Telephone: (0753) 821922.

IBM goes for graphics

IBM HAS announced a series of products for people who require high-resolution graphics, including scientists and engineers as well as graphic designers. The main products are a graphics monitor and a graphics-controller card, which includes an Intel 8088 chip.

The system is able to display 256 colours from a palette of 4,096, with a resolution of 640 by 480 pixels. It is also able to rotate, translate and scale drawings. The display costs £1,226 and the controller card £2,829.

Other products in the range are a development toolkit £379, graphical file system £169, graphical kernel system £278, plotting system £211, and graphics terminal emulator £278, which emulates the Tektronix 410X and Lear Siegler terminals.

Further accessories are also available for controlling laboratory processes. IBM has also launched Ryan McFarland's ANSI-77 standard Professional Fortran at £555.

Add VAT to all prices given. Contact your local IBM PC dealer for details.

Smartwork

IF YOU design printed circuit boards up to 10in. by 16in. Smartwork is a specialised colour-graphics program that lets you do it on an IBM PC. If you want to join two conductors, you just mark them and the program draws the shortest line that does not cross other conductors on the same side of the board. The program also enforces minimum line spacings and trace width. On completion the artwork can be printed out on a dot-matrix printer or pen-and-ink plotter.

Smartwork was designed by the Wintek Corporation in Lafayette, and costs £895 in the U.K. A demonstration disc is available for £10. A complete system including the computer, training and maintenance costs around £4,000. All prices exclude VAT.

Contact Coquin Software, 14 Goodwood Close, Morden, Surrey SM4 5AW. Telephone: 01-646 3493.

Persona

A NEW company has been formed to distribute IBM PC add-ons, and the first offerings available are PC Supercharger, G/Net, Comgraphics, Piggyplus and Comtronics cards.

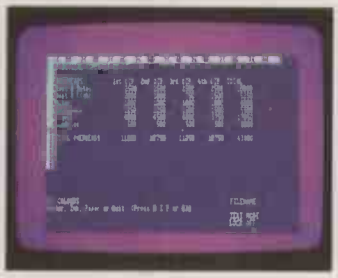
PC Supercharger is a board that has been developed by Gateway Communications in Irvine, California. It has an 80186 chip running at 7.16MHz and from 128K to 1Mbyte of RAM, which is claimed to make an IBM PC run up to 10 times faster.

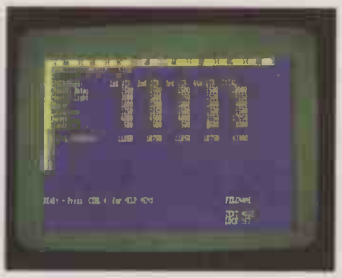
G/Net is a local area network, also developed by Gateway. It can connect up to 255 IBM PCs or compatibles using coaxial cables over a distance of up to 7,000 feet. There are SNA and X-25 gateways also available.

The remaining products have been developed by Comway Electronics, a firm based in Toronto, Canada. Comgraphics is an IBM and Hercules-compatible card for running graphics on the green monitor with a 720- by 348-pixel resolution. Comtronics is an enhanced IBM colour-compatible display adaptor. It offers four colours with a resolution of 640 by 200 pixels, or 16 colours with 320 by 200 resolution.

Both cards have a parallel port, and can handle extra memory via the Piggyplus board. This expands memory to 448K and includes a RAM disc, print spooler, clock/calendar with battery backup and a games port. The Piggyplus board is also available separately if you happen to have a spare expansion slot.

For further information contact Persona (U.K.) Ltd, 38 High Street, Kingston upon Thames, Surrey KT1 1HL. Telephone: 01-541 4343. PC





Amstrad disc software

AMSTRAD'S software arm, Amsoft, has released a large number of disc-based software packages for the Amstrad CPC-464. Games, home-education programs and several serious packages suitable for business use are among the titles on offer. At the same time Amsoft has released details of a forthcoming full accounting suite for the CPC-464, which up to now has been regarded as a home enthusiast's machine.

The change in emphasis follows the introduction of Amstrad's add-on disc drive for the CPC-464, which is now being shipped in quantity. Price of the 3in. Hitachi-based disc unit is £199 including VAT, which includes DR Logo and CP/M 2.2.

The new software releases include a word processor, Microscript, and a database, Micropen, which each cost £49 including VAT; either package can accept data transferred from the other. Amsoft is offering two disc-based spreadsheets: a full-feature one with built-in financial functions, called Microspread, price £49, and the simpler Mastercalc at £29.95.

Several titles from Triptych Publishing's Brainpower business-education range are now available on disc. Entrepreneur, Project Planner and Decision Maker are priced at £29.95. Star Watcher, a program which teaches you the constellations, costs £23.95.

Programmers are not forgotten, with Hisoft Pascal priced at £39.95, and Screen Designer, a graphics programming utility, at £18.95. Games on disc are generally priced at £12.95 and include Code Name Mat, Durrell's Harrier Attack, and Chess from Micro-Gen.

Amsoft's accounting suite is due to arrive in April. The set of five linked accounting packages from Quest International are basically the same as the well-known Padmede programs. The stock control, invoicing and sales ledger modules are closely integrated and sold as a set, price £99 including VAT. The purchase and nominal ledgers will link in to the rest of the suite, but are available separately at £33 each.

Contact Amsoft, Brentwood House, 169 King's Road, Brentwood, Essex CM14 4EF. Telephone: (0277) 230222.

Free Commodore software

THE FOLKLIFE TERMINAL CLUB is an international Commodore user group based in the United States, which has an archive of over 6,000 public-domain programs. The Club has just issued a new catalogue and is making its software library available to other Commodore users for a charge of $15 per disc to cover media mailing.

The programs range from educational, scientific, and utility software to business applications and games. The catalogue disc listing the available programs is probably the first one to order.

The Club supports Commodore 64, Plus-4, Vic and most Pet configurations. The $15 per disc is probably best paid by a Post Office international money order.

Contact Folklife Terminal Club, Box 555-SB, Co-op City Station, Bronx, NY 10475, U.S.A.

Software shorts

● Optionware is a range of nearly 60 pre-programmed Lotus 1-2-3 applications templates. Subjects covered include financial statistics, budgeting, asset management and personnel. Any individual Optionware module costs £75, while a set of five in one subject area costs £299. Contact First Software on (0256) 463344.

● Mac-BCPL is the latest language available on the Macintosh. BCPL is a compiled high-level language particularly suited for developing system software and other high-performance programs. The Mac version costs £145 plus VAT. Details from Top Express Ltd. Telephone: (0223) 355427.

● Audiogenic is offering Commodore 64 users a demo version of its Micro Swift cassette-based spreadsheet program for 50p. The full working version costs £19.95. Contact Audiogenic on (0734) 664646.

● Index-Aid consists of two programs which assist in the compilation of indexes. The first is the compilation program proper, the second gives you control over the form of the final printed index. Available for the Osborne 1 or the IBM PC, Index-Aid costs £30. Details from ALLM Books, 21 Beechcroft Road, Bushey, Hertfordshire WD2 2JU.

Mac Pascal compiler

TDI has launched a compiled Pascal for the Macintosh. Macadvantage is a UCSD Pascal compiler which supports the full range of features contained in the Mac's toolbox ROM, including pull-down menus, multiple windows and mouse routines.

The significance of the product for software developers is that it allows them to write Mac applications programs which will run on any Macintosh. End-users will not need a run-time Pascal system.

Apple itself offers two versions of Pascal, but there are drawbacks to both. Mac Pascal is interpreted, so only people who have a copy themselves can run programs written in it. Apple's Pascal compiler only runs on the Lisa; you can use it to develop software for the Macintosh, but you need to have both a Mac and a Lisa to do it. The price for Macadvantage is £295 plus VAT. Details from TDI Ltd. Telephone: (0272) 742796.

Apple II indexer

BOOKENDS for the Apple IIe and IIc lets you create an index of books or articles with an abstract of up to 720 characters per book. You can then search by author, title, keyword or any phrase contained in the abstract. Bookends costs £105.95 plus VAT. Details from P&P on (0706) 217744.

Samna Word III

WORD III is the latest and most powerful word processor in the Samna family. Running on the IBM PC and other popular MS-DOS machines, Word III is a general-purpose word processor, but with special features making it suitable for technical and scientific documents and writing in foreign languages.

Word III comes with eight alternative keyboards predefined in software. You simply select the French, German or Spanish keyboard, for example, and the appropriate symbols and accents are generated as you hit the keys. A scientific keyboard with Greek and mathematical characters is included among the eight.

The package also has an an 80,000-word spelling checker built-in, and links to Samna's financial-modelling and text-retrieval packages. The only problem is the price: £503 plus VAT.

Contact Softsel Computer Products, Softsel House, Central Way, Feltham, Middlesex TW14 0XQ. Telephone: 01-844 2040. PC

McPic is the latest in a growing number of picture libraries for the Macintosh. McPic comes on two discs, each costing £49.95 plus VAT and each holding about 130 images. You paste copies of the picture into documents created with Macwrite, the Macintosh word processor, or most other Mac programs. Contact P&P on Rossendale (0706) 217744.

QL quickies

● Sinclair Research has released version 2.0 of the word-processing, spread-

sheet, database and graphics application software bundled with the QL. The new versions are claimed to work 20 to 30 percent quicker and load twice as fast. Because the code is now more compact, more space is left for the user's files. The version 2.0 software is included in the price of all new QLs, currently £399 including VAT. Existing QL owners who have joined Sinclair's QL User Bureau should be receiving the upgrade through the post without charge.

● Another 68000 assembler has joined the list competing for the allegiance of keen QL Programmers The latest offering is distributed by Sinclair itself and written by GST computers. The assembler comes with a full-screen editor and costs £39.95 including VAT. Competing assemblers are available from Bristol-based Metacomco and Adder Publishing of Cambridge. Contact Sinclair Research Ltd, Camberley, Surrey GU15 3BR. Telephone: (0276) 686100.

● Prolog is on the way for the QL, although actual delivery of the product is still several months away. Expert Systems International Ltd has signed a contract with Sinclair Research to produce a version of the artificial intelligence language for the 68008-based machine. QL Prolog is to cost under £100, while the basic QL costs £400 at the moment. These prices will make the QL/Prolog combination the cheapest way to get hold of a working Prolog system, and should guarantee plenty of interest, particularly among the university AI fraternity. Contact Sinclair Research for details.

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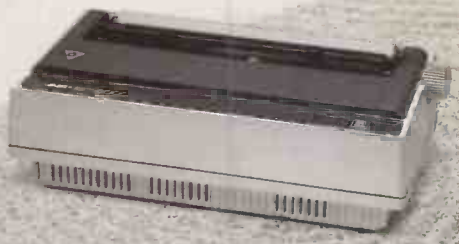

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● Circle No. 138

Rough and tumble

OLIVETTI is to acquire a 49.3 percent shareholding of **Acorn**. This follows the announcement of losses by Acorn of £10.9 million in the six months to 31 December 1984.

The company will be split up into four divisions: education and training; scientific and industrial; business; and consumer. A further 90 jobs will go in addition to the 30 redundancies already announced. Dr Alexander Reid, who joined the company recently as acting chief executive, is to become chairman, with Hermann Hauser and Chris Curry as joint deputy chairmen. A Group Managing Director is to be recruited externally.

Hauser and Curry's combined shareholdings will go down to 36.5 percent from 85.7 percent. Olivetti has an option to increase its holding to 50.1 percent within the next five years.

Olivetti's moves follows the suspension of Acorn's shares on Wednesday 6 February. They then stood at 28p against a 1984 high of 193p. On Friday 1 February, Acorn had sacked its merchant bankers Lazards. As a result, its stockbrokers Cazenove resigned. Acorn has appointed Close Brothers as its new financial advisers, and Phillips and Drew as its brokers. The proposed takeover of Torch computers will not now take place.

Partly as a result of the adverse publicity resulting from Acorn's troubles, **Sinclair** has postponed its share flotation on the USM. Sinclair has also stopped taking deliveries of all its computers from sub-contractors. The company blames overstocking by retailers in the pre-Christmas period.

Meanwhile, **Oric** called in the receiver on 31 January. Debts stand at about £6 million; the book value of stock is about £3 million. According to the receiver, three firms are showing an interest in Oric. Two are French, and the third is continental with British connections.

The new owners of the **Lynx** range, Anston Technology, has announced that it will not restart production of the Lynx 48 and 96 for the U.K. market. Support will continue for existing owners. Prices have been cut on remaining models. The Lynx 128 costs £299, down from £399; the 250K disc drive with controller costs £249, and the 1Mbyte version £269; all prices include VAT.

Things are not entirely quiet on the American front, either. The U.K. General Manager of **Commodore**, Howard Stanworth, resigned and left at the end of February. According to the company, the parting was amicable. No reason has been given for his departure.

Commodore earlier reduced the price of the Plus-4 from £299.99 to £149.99. Meanwhile, in America itself Commodore has laid off over 500 employees as a result of its high stock levels.

The only home-micro manufacturer looking bullish is **Atari**, under the ebullient leadership of Jack Tramiel. While the world waits for the ST supermachines — see interview on page 31 — Atari is offering a restyled 800XL, together with a 127K disc drive, for £249.99 including VAT, instead of the usual £364.96.

Microsoft Press

A YEAR AGO, Microsoft went into the book-publishing business in the U.S. and produced some excellent books, particularly about the Apple Macintosh. They are now to be distributed outside the U.S. by Penguin Books.

The initial offerings are *The Endless Apple, The Apple Macintosh Book, Running MS-DOS, Mac Work Mac Play* and *Managing your Business with Multiplan*. Titles on the way include *Learning Commodore 64 Logo Together, Getting Started with Microsoft Word, Word Processing Power* and *Putting dBase III to Work*.

Contact Penguin Books, 536 Kings Road, London SW10 0UH. Telephone: 01-351 2393.

Business Computer Show

THERE ARE more than enough computer shows already, so why launch yet another? The answer to that is: "Because this one is different".

The Business Computer Show is the first national exhibition to be aimed specifically at people who are not computer experts. The idea is to attract the small business user.

During the show a business advice centre will be run by the Department of Trade and Industry and the National Computing Centre. There will also be a communications centre, to feature the latest electronic mail, networking and messaging technologies.

The established exhibition, Software, sponsored by the Institute of Data Procesing Management, will be held in the same place at the same time.

The Business Computer Show is being sponsored by *Practical Computing* and *Computer Weekly*, and supported by the British Computer Society and the Computing Services Association. The show will be held at Earls Court, London, from June 4-6. Admission is free.

Contact Reed Exhibitions, Surrey House, 1 Throwley Way, Sutton, Surrey SM1 4QQ. Tel: 01-643 8040. PC

Celebrity Chatline

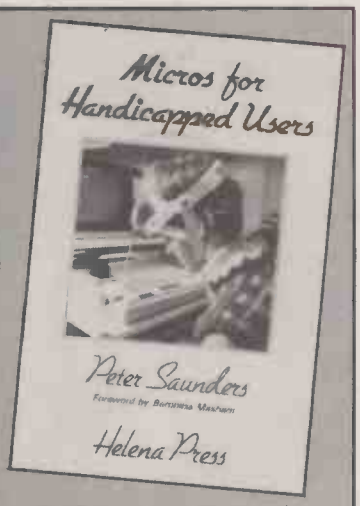
FROM MARCH 20 Micronet 800, the specialist microcomputer users group on Prestel, is launching Celebrity Chatline. Each Wednesday evening a computer celebrity will be interviewed live on viewdata, and everyone logged on will be able to type questions on to their terminal for the celebrity to answer. In other words, it is the computer equivalent of a phone-in.

From March 27, the celebrities taking part are Derek Meakin, publisher of Telelink, journalist Guy Kewney, Mike Singleton, author of *Lords of Midnight*, Paul Duffy of the guild of Software Houses against piracy, and Nazir Jessa of Watford Electronics.

For more information contact Micronet 800, Telemap Ltd, 8 Herbal Hill, London EC1R 5EJ. Telephone: 01-278 3143.

Books received

● *Micros for Handicapped Users* by Peter Saunders. Published by Helena Press, £5.95 ISBN 0 9507930 2 7. An excellent introduction to computing for those who are handicapped, and also an invaluable source book of addresses, information and ideas. The book covers North America, Australia, the U.K. and parts of Europe.



● *Mr Babbage's Secret* by O I Franksen. Published by Strandbergs Forlag, Denmark, DKr 320. ISBN 87 872 0086 4. An idiosyncratic book in the grand but short tradition of Hofstadter's *Gödel, Escher, Bach*. It weaves together such diverse subjects as Charles Babbage, APL, cryptography and Viking runes. An intriguing book, but not easy.

● *The Apricot Personal Computer* by M de Pace. Published by Collins, £8.95. ISBN 0 00 383002 0. A very basic guide to the Apricot and to programming in general. There are chapters on Basic, spreadsheets, word processing and databases. There is little of interest to the hardened user, but it is useful for beginners.

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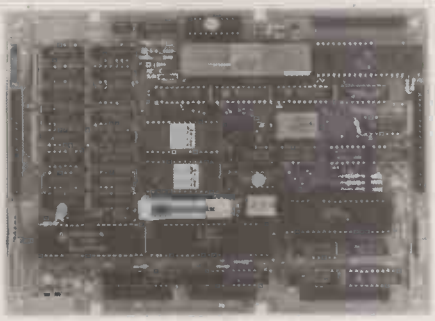

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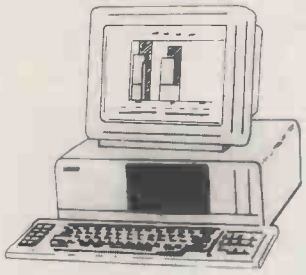

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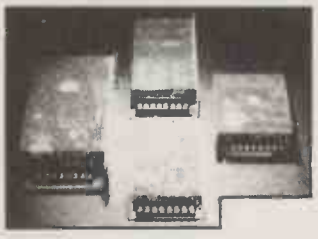

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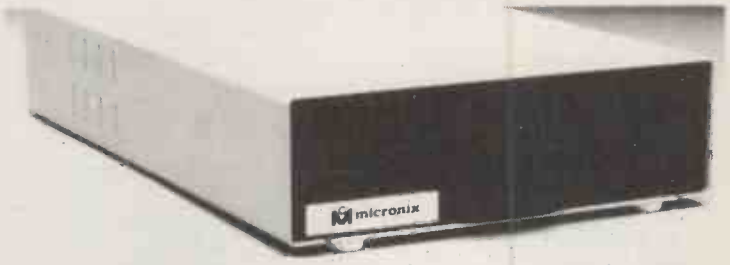

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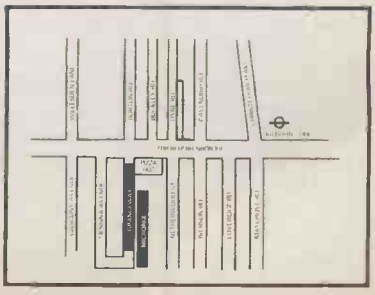

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● Circle No. 143

Enter the Jackintosh

To what extent will the ST be used in business?

I believe it will be quite substantial.

Will there be any distinct drive to sell it to business?

There will not. I will be selling it through individuals. And if any business is smart enough that they want to come and buy it from our dealer, they will be welcome. We will not have a business division, as such, trying to concentrate on the Fortune 500s.

You are offering Logo as well as Basic as the bundled language. Are you intending to give any kind of educational discounts in the way that Apple has?

We will definitely have special schemes for schools, but we don't need to do the same thing as Apple, because the Apple discounted price is twice as high as our normal price. It will be at all three levels of education.

What about future add-ons for the ST?

There are quite a few add-ons, especially in the hard-disc area, and in the music area. Then we are going to have a whole line of printers.

Are you going to bring out a laser printer?

We are working on a laser printer but not for this line. It's for our next generation.

Will the next generation be 32-bit?

Yes, it will be.

Will it be based on the 68020?

When you see it you'll know about it.

When can we look forward to the next generation?

It will definitely be this year.

Will it be TOS compatible?

No. This is the one area a lot people do not understand. When you work with technology, you don't go backwards, you want to go forwards. If it's feasible and possible to have it compatible, you will. But if technology is that far ahead of the previous machine, then they won't be compatible.

More generally, how do you see the next generation of computers developing?

I think much more capacity, much faster speed, much more multi-tasking networking, and having very, very large databases almost built into the machine.

JACK TRAMIEL, Chairman and Chief Executive Officer of Atari — interviewed by Glyn Moody.

Jack Tramiel founded Commodore Business Machines in 1955 as a firm manufacturing typewriters and adding machines. In the 1960s it moved into the electronic-calculator field, and in 1977 into the world of micros with the first of the Pet series.

Early in 1984, Tramiel left Commodore because "I could no longer come into work with a smile on my face." Later that year he acquired the ailing Atari from Warner Communications, together with estimated debts of around $400 million.

Only a few months later, Tramiel announced new machines at the Consumer Electronics Show in Las Vegas that astonished the micro world. Chief among the wonders unveiled there was the ST series. Based on the powerful Motorola 68000 chip, the 130ST offers a Macintosh-like environment with 128K RAM for only $399. The 512K version, the 520ST, costs $699. Peripherals include a 3.5in. 500K floppy for $100, plus a range of monitors and printers.

What uses do you see this power being put to?

For a doctor, for example, instead of having to wait for some information, such as what is the newest thing on cancer, or to see what people have done when this case has come up before, he will have a database on that particular sickness. He'll go to his computer and in seconds he will have the information in front of him.

Are you talking to information providers about setting up co-production deals?

Yes. Those are the kind of things I want to bring — those kind of libraries — to the individual, so that you don't have to be a huge corporation to afford this kind of information. The kid which has a coal miner as a father will now have this kind of information. And maybe he won't have to be a coal miner, he can be a businessman, he can be a doctor. A machine like this only 10 years ago was a half a million dollars, where now you might be able to buy it for a thousand dollars. So we're bringing the computing power to the individual. That's what I want to give to the end-user.

Do you see that tying in with things like interactive video?

There's no question. There is a company called Plato, who have more than 2,000 educational programs — really advanced programs — which were being taught in high schools. All of sudden we were able to take those 2,000 and put it on a little disc.

How do you think the micro marketplace is going to develop in the future?

I believe that it's going to settle down. I have never taken any company seriously which did not have an international base. To be successful in the micro business you have to think internationally, not nationally. As soon as you are caught up in your own country and can't look worldwide, you don't have a market worldwide, and you don't make it.

Do you think that the British efforts are rather small-scale and parochial?

That's right. I would work with the British government, on how can we make a computer that is good for the world, not good for Britain.

How do you regard the MSX idea?

MSX, I think, was basically a fantastic idea for Microsoft to sell software. But it was very backward technology, going to a Z-80 which was technology from 10 years ago. So my friend Mr Gates has done a fantastic marketing job. Thank God they failed.

So do you see things driven fundamentally by technology?

No question. That, I believe, is our success. I always believed that microcomputers were technology-driven not marketing-driven. You always have to be your biggest competitor. Try to make every time a better product to compete against yourself. Never fall in love with the product that you have right now, but if there is better stuff out there, make it. PC

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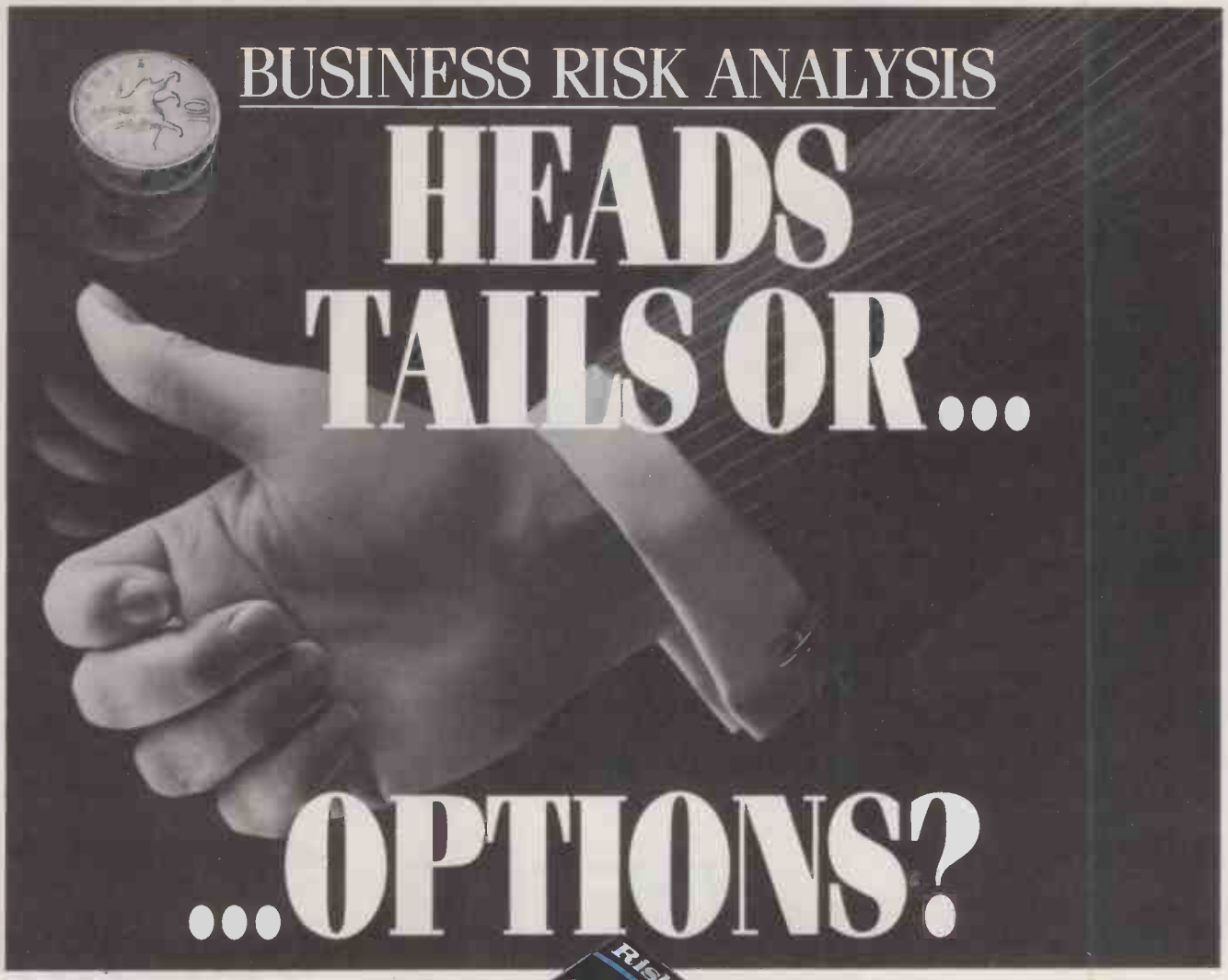

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PCI

by Ray Coles

Looks fine

Handling very detailed displays requires a complete rethink of the graphics circuitry. A new VLSI chip family has just arrived to take on the task.

IN THE BEGINNING, there was low-resolution monochrome graphics. Microcomputer screens were divided up into character cells, and the screen-refresh memory consisted of about 1K of RAM with each byte containing either a standard ASCII character or a code to select one of a range of special graphics characters.

Screens could handle about 24 lines of 40 characters per line, and the definition of each character was stored in a special character-generator ROM which described each character on a dot matrix of about six by eight points or pixels. By this means the puny 1K screen memory could provide an apparent dot resolution of 240 by 192 pixels, but with the important proviso that a sort of indirect addressing into the character ROM was necessary to access individual pixels. To write pictures rather than words on the screen, special graphics building blocks had to be available in the character-generator ROM. To produce a particular picture, first character cells and then appropriate graphics characters had to be selected by the program — an arduous business even on those few machines with RAM-based character generators.

Cheaper memory

As memory prices fell and screen-refresh memories could be increased in size, it became possible to address pixels directly rather than via a character generator and the so-called bit-mapped graphics approach became standard. Screen resolution of 128 by 128 became possible using 16K DRAM chips for example, and up to 512 by 512 with the more recent 64K DRAMs. All the earlier systems, whether character- or bit-mapped, used only one bit per pixel. So the lucky graphics programmer had a choice: pixels could be either On or Off.

With memory prices dropping ever lower, it became possible to store more than one bit per pixel, and this provided the next improvement: colour. Even with only two bits per pixel, it was now possible to have a choice of one of three primary colours as well as Off. As more bits were added the possibilities increased in powers of 2.

Far from perfect

The current state-of-the-art for the most sophisticated personal computers would be a 512- by 512-pixel screen with eight bits per pixel using, say, eight 256K DRAM chips and providing 256 colour possibilities. When you see such a screen it certainly looks very good, but it is still far from perfect for many tasks such as computer-aided design so the race is on to achieve better still.

If you have sufficient funds you can have the next stage today. It provides 1,024- by 1,280-pixel resolution, up to 16.8 million colour hues per pixel — and you don't get much change out of

Conventional technology limits resolution, even for CAD work stations where detail is most needed.

£100,000. The problem is that after 512 by 512 pixels, system design becomes a whole new ball-game because that is about the highest resolution that can be achieved on current 525- and 625-line monitors.

Going up to 1,024 by 1,280 requires a lot more than just 1.25Mbyte of memory. It also requires a completely new colour CRT design and some sophisticated analogue electronics. To prevent flicker, any raster scan display, regardless of definition, has to have a frame-refresh rate of 50Hz or more. On a 625-line 512 by 512 graphic screen, individual pixel data has to be clocked at around 10MHz to keep up with the raster. On a 1,024-line, 1,024-by 1,280-pixel screen, the dot-clock rate approaches 100MHz — and that's VHF.

Put 1.25Mbyte of RAM, an exotic CRT and VHF-drive electronics together, and you can see why really high-resolution graphics are only available to the chosen few at the moment. Fortunately for us technology marches on, and when your 1990s-vintage machine emerges from its chrysalis don't even look at it unless it sports 1,024 by 1,280 resolution. Nobody can doubt that the screen-refresh memory will be cheap enough by then: 1Mbit DRAMs are already running in the labs. The CRT technology already exists in Japan, and with the forthcoming introduction of high-resolution television direct-broadcasting by satellite a mass market will emerge to bring CRT prices down.

As far as the drive electronics are concerned some companies are already hard at work putting the necessary ingredients on to LSI chips, as a new family of high-resolution graphics chips from AMD demonstrates. The team consists of the Am 8150 video-shift register and the Am 8158 video-timing controller. Together they provide just about everything required to build very sophisticated graphics systems indeed.

The Am 8150 takes charge of up to 1.25 million words of screen-refresh memory and arbitrates between the conflicting requirements of the processor, which wants to asynchronously write new graphics data into the memory, and the screen, which has to be updated at the raster rate. In addition, it provides all the fancy addressing to allow smooth panning and scrolling.

The Am 8157 is needed to increase the apparent speed of the memory array. Fast dynamic RAMs have access times of about 100ns., but to write 1.25 million pixels 60 times a second, access times of less than 10ns. are necessary. The video-shift register can be loaded with up to 20 bits at a time which can then be shifted out serially at clock rates of well over 100MHz. The Am 8158 provides the necessary heartbeats for the whole system, generating vertical and horizontal sync pulses, blanking pulses, and the dot and character clocks from a crystal oscillator running at up to 125MHz.

16 million hues

Pride of place goes to the fantastic Am 8151 color palette, three of which provide the colour maps to drive three eight-bit colour channels, giving a possible colour range of 16.8 million hues. Each Am 8151 colour channel has a 256 by eight high-speed RAM-based look-up table and a fast eight-bit digital to analogue converter which provides the analogue video output.

The look-up table approach provides a 24-bit dynamic colour range, but requires only eight bits of data per pixel. In effect, the eight-bit picture data is encoded into 24-bit form and although at any one time only 256 colours are available, the programmer can reload the tables at any time. A nice touch is the incorporation of a text-overlay facility which produces a whiter-than-white image from a binary memory plane so that text always shows up, even on white graphics. PC

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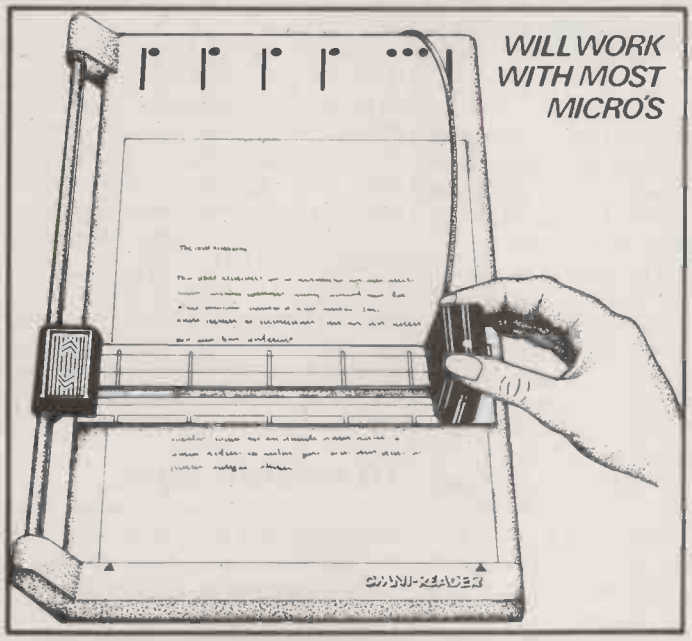

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Infomata will be holding their next seminar at St James Court in Warrington on 11 April 1985. If you would like to see POLICY MASTER in action on the Delta 505 or if you would like more information ring Terri Pope of Infomata on Warrington (0925) 572870.

With over sixty years total experience in business computing, consulting Infomata would certainly seem to be a case of adopting the right policy.

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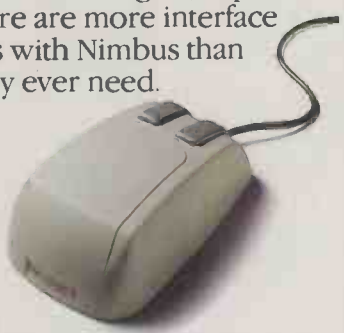

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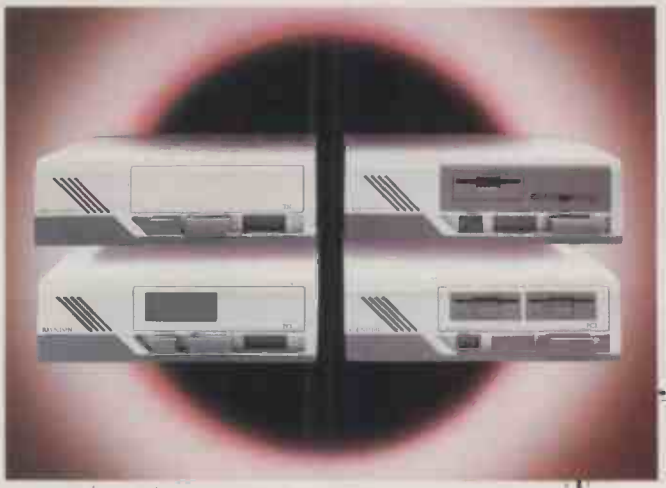
Within the same neat unit, you can specify Nimbus with single or twin 3½" disc drives. With a built-in Winchester. Or without discs as a network station. And talking of networks, Nimbus uses the MS-NET* operating system, which will allow up to 64 stations to share software and network facilities at high speeds.



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There is much about Nimbus that cannot be conveyed in words. Its superfast graphics, for instance, or its elegant, user-friendly design. To find out more about Nimbus, use the coupon below, or phone Research Machines on Oxford (0865) 249866.

*MS-DOS and MS-NET are trade marks of Microsoft Corporation.
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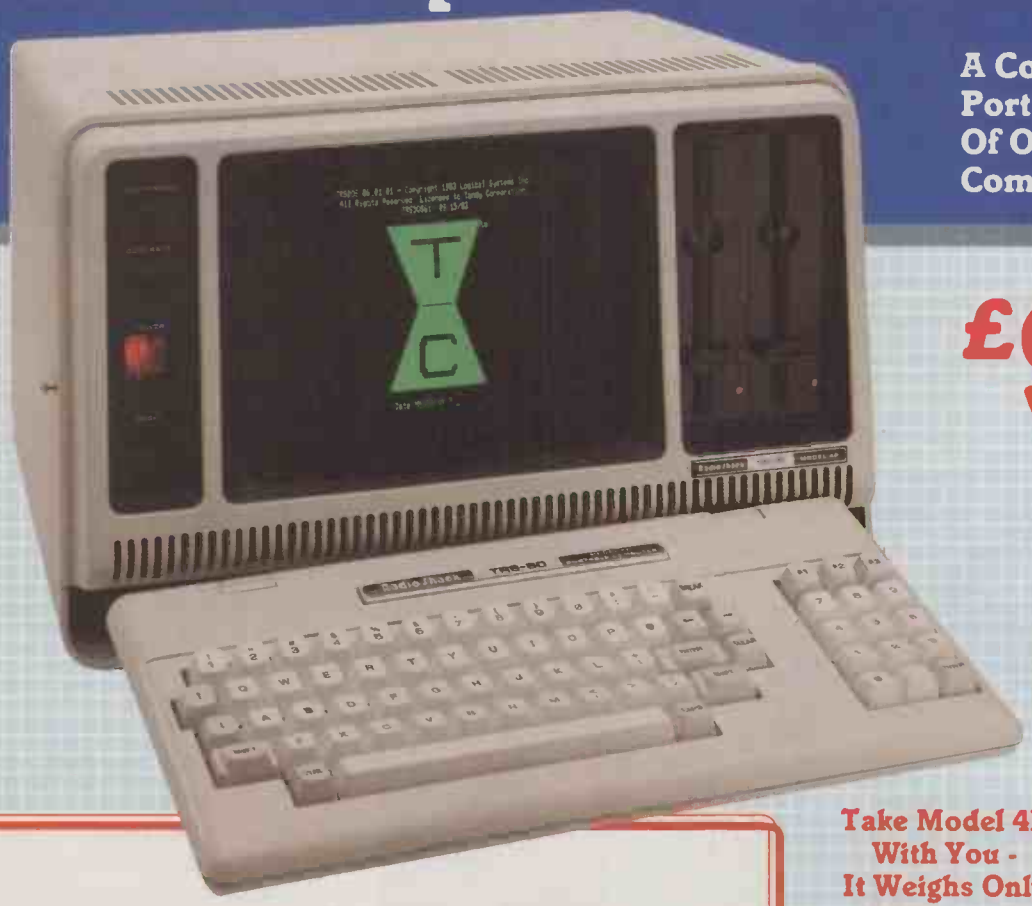

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by Ben Knox

Handle with care

The U.S. cult communications system CB Simulator looks set to win some British addicts.

COMPUSERVE is one of the largest and most popular information systems for U.S. computer users. The system started in the 1960s as a fairly boring computer bureau for small users who needed to run, say, accounting programs, but could not afford a computer. Compuserve found that while its computers were being used heavily in the daytime, throughout the night they were doing little but run adventure games for the benefit of the night-shift operators.

Then a bright chap in the company suggested that Compuserve put some interesting information on the system and allow home-computer users to log on, charging them for the privilege. The jumped-up Bulletin Board System, BBS, that resulted was called Micronet — no relation to the more recent section of Prestel that operates under the same name.

Extensive facilities

Micronet has since changed its name to Compuserve Information System, CIS, and has grown to fill over 40 DEC 10 mainframe computers. Even the extensive facilities of Prestel, which occupies six GEC minicomputers, pale in comparison to the amount of computing power available on CIS.

CIS provides services in three main areas: business, home and computing. Under business and home you will find all the usual services, much like Prestel. These include news, stock and share prices, weather reports, teleshopping facilities, TV, film and product reviews, plus hundreds of other things. However, the services provided specifically for computer users are the most comprehensive, and worth discussing in more detail.

In keeping with its BBS roots, special interest groups or Sigs are provided for most U.S. brands of microcomputer. In these areas you can leave messages for other users or pleas for help. There is also an excellent electronic computer magazine — I write for it — with a news section which is updated throughout the day.

Chatty users

However, the most fascinating and addictive part of CIS is CB Simulator, a sort of electronic version of Citizens' Band radio. In this area, users can chat to each other via their keyboards, which makes it somewhat like Chatline on Micronet 800. You type a message on your keyboard, and some time later everyone else on Chatline gets it on his or her screen. The difference between Chatline and CB Simulator is that on Chatline it can take between three and 30 minutes for your message to appear, whereas on CB Simulator messages appear instantly.

As its name suggests, CB Simulator is set up very much like CB radio. The Simulator is run on two mainframes called, imaginatively, A and B. On each mainframe there are 36 channels which you can "tune" into. Anyone on a particular channel can only "broadcast" to other people tuned into the same channel. As about 50 people can be on each channel, the theoretical maximum number of CBers, as they are called, is 3,600 at any one time.

> On CB Simulator "everyone is totally equal. It doesn't matter what sex or race you are or what you look like, or handicaps or whatever. People judge you on your ideas, on how you communicate."
>
> Pat Phelps, Product Manager, CB Simulator (Handle: Looloo)

When you enter CB Simulator, you are asked what handle you want — as in CB, handles are used instead of names. Then whenever you send a message, the system will automatically add your handle to the beginning, along with the mainframe and channel indentification, so no one gets confused.

CB Simulator is very addictive. Just imagine having a conversation where 20 or 30 people can all talk at the same time. You can become quite attached to other CBers, and a number of couples have actually got married. The first couple to meet on the system and marry even had a terminal at their wedding on St. Valentine's Day, 1983. The proceedings were entered so that the bride's parents, who "witnessed" the wedding on their own computer, and all their CBer friends could join in. When the same couple had their first baby last year, there was a terminal in the delivery room.

The problem with chatting via a computer is that you cannot see or hear the other person, but the meaning of a spoken sentence is often shaped by the intonation and the facial expression which accompanies it. Obviously a line of text on a VDU cannot convey expressions, so CBers add stage directions between < > symbols at the end of their messages. A typical interchange might look like

(A1, Old Man) Does anyone know what the time is?
(A1, Big Mama) Way past your bedtime <smile>!
(A1, Old Man) Hm. . . . <frown>

or

(A20, Ricky) Hi everyone!!!
(A20, Mystery Lady) Hello Ricky!! <HUGS & KISSES>

You get used to it after a while.

Unfortunately, you cannot simply dial CB Simulator directly from Britain. You need to get hold of a Compuserve starter pack, and these are only available in the U.S. What is more, Compuserve will not mail one over to you. You have to get a U.S. dealer to do so.

Password supplied

Starter packs contain a manual, an ID number and a password and cost either $20 or $40, giving you one hour and five hours free connect time respectively. When you log on to CIS with your starter pack ID you will be given the opportunity to sign up fully, giving your credit-card number for billing purposes.

The connect-time charges are very high compared to services in the U.K. Prime time is about $13 per hour. The cheap rate is $6 per hour. These charges do not include your PSS charges of £6 per hour, or the cost of the call to your local PSS exchange.

My ID on CIS is 72236,3112. My handle on CB is UK Ben. Send me a message when you join. But remember that in the U.S., CB Simulator addicts often run up bills of £1,000 per month, so be careful. Contact Compuserve Inc., at 5000 Arlington Center Boulevard, Columbus, Oh 43220, U.S.A. Telephone: (U.S. area code 614) 457-8600. PC

Ben Knox can be contacted via snail mail c/o *Practical Computing*, or electronically on Telecom Gold: 84:TCC051, or Prestel mailbox: 919993567, or on the Thames TV/Homelink Bullet — details of that next month.

Practical Computing is also on Telecom Gold: 81:JET727. The Editor is on 83:JNL020.

Castaway on a knowledge Island?

In the modern office, personal computers, however sophisticated, have one major drawback.

They tend to maroon their users on a series of knowledge islands.

With communications getting shipwrecked along the way.

The problem is, shared information means shared resources. Which is not what PCs were designed for.

Unfortunately, trying to network your PCs by adding more of the same, rigged together with a jumble of cables, is also taking the wrong tack.

All you get is an expensive duplication of hardware – and a compromise in performance. And the more users you add, the worse the problem becomes.

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PC4/85

by Mike Lewis

More into less

Some more ways to save space and speed up program execution.

DATA COMPRESSION is the art of squeezing more and more information into fewer and fewer bytes. It is a subject that continues to attract the interest and attention of programmers. After all, if you can find a way of packing two eight-bit values into a single byte, you only save substantial amounts of RAM or disc space. You also benefit from faster table searches and disc accesses, which means speedier programs.

In June last year, Software Workshop looked at a method of compressing natural English text to just 49 percent of its normal length, without any loss of information. The scheme works partly by using the in-built redundancy in the ASCII coding system, which has 161 wasted values when representing text, and partly by assigning fewer bits to the commoner letters and words than to obscure ones.

The technique works beautifully for correspondence, articles, reports, etc., written in normal English, though it can be adapted for other languages. But if you tried to use it for other types of information, such as spreadsheet data or a name and address list, you would probably end up with a file that was many times larger than the original.

So what the programmers need is a collection of compression techniques, so that they can choose the method that is most appropriate for a given type of data. One possible method is designed for ordered lists, particularly aphabetical word lists such as dictionaries. A second method is a technique commonly used to compress bit-mapped graphics.

Common letters

The dictionary-compression scheme is based on the fact that in any alphabetically-sorted list of words, groups of neighbouring words will tend to have the same first few letters in common. So you can save space by recoding each word as a number followed by some letters, the number being simply a count of the letters copied from the previous word.

For example, the list

exert, exhibit, exhibition, exile, exist, exit

would be recoded as

exert, 2hibit, 7ion, 2ile, 3st, 3t

You can achieve a further reduction by eliminating the space character, or other delimiter, that marks the end of each word. Instead, you detect the end of a word by looking out for the numeric character that introduces the following word. Of course, this assumes that digits never appear in their own right in the list and that the count is always present. So a count of zero must be inserted if no letters are carried forward from the word before.

You can then go a stage further by storing each character of the compressed text — that is each letter or count — as a six-bit number rather than in a full byte. This could be done by assigning the values 0 to 16 to the counts, and 17 to 42 to the lower-case letters, a to z. This still leaves 21 values free for hyphens, apostrophes, shift characters and the like.

To get an idea of the overall space savings that these techniques can achieve, it is worth looking at Wayne Holder's superlative program The Word Plus, marketed by Oasis Systems. It would denigrate this program to refer to it merely as a spelling checker but it does include a 45,000-word dictionary which the publishers were anxious to squeeze on to a single-sided 5.25in. floppy disc. The original dictionary ate up 450K. By using all of the tricks described here the author managed to reduce it to 140K, a saving of 69 percent.

Sequential searching

The snag with this type of compression is that you can only retrieve words by scanning the list sequentially, rather than by faster means such as a binary search. But this is not as bad as it sounds. In some applications, you are stuck with sequential searching anyway. The hypothetical travel enquiry service described in last month's Software Workshop is an excellent example because the search has to proceed at the same time that the searched-for value is being obtained from the keyboard.

You can also speed up the search considerably by employing a thumb index, which is another technique used by The Word Plus. This is simply a set of pointers to the first word beginning with each of the 26 letters of the alphabet. The slowest possible search in The Word Plus dictionary is for the word "systole". This is because s is the commonest initial letter in English and systole is the last word in the dictionary beginning in s. Using a Z-80 based Kaypro 10 with a hard disc, a search for it took under two seconds.

Searching The Word Plus dictionary can be great fun, especially if you are fascinated by words or addicted to crossword puzzles. The software includes a pattern-matching routine, which makes use of wild-card characters, and an anagram finder. If you have always wanted to know

(continued on next page)

How much space is saved?

The amount of space that you can save by dictionary compression depends on how close successive entries are to each other in alphabetical order. As a worst case, consider a list in which each word begins with a different letter. The compressed list would consist of the original words, each preceded by a zero count. Since the count would serve in place of the inter-word delimiter, the net reduction of space would be nil. A saving of 25 percent would still be possible by encoding the list as six-bit values, but this would also apply to any text which contained few special symbols, numbers or capital letters, not just to dictionaries.

At the other end of the scale, consider the following list obtained from the *Pocket Oxford Dictionary*. Here the compression amounts to 60 percent. Far greater reductions would be achieved if the list included derivations, such as receiver, recently and recessional.

original word	length	compressed word	length
recede	6	0 recede	7
receipt	7	4 ipt	4
receive	7	5 ve	3
recent	6	4 nt	3
receptacle	10	4 ptacle	7
reception	9	6 ion	4
recess	6	4 ss	3
recession	9	6 ion	4
Totals	60		35

The space between the count and the other letters in the compressed words are included for legibility only and would not be stored with the data. The total space occupied by the original list is 68 bytes: 60 letters plus eight delimiters. The total space occupied by the compressed list is just under 27 bytes: 35 multiplied by 6/8. The saving is therefore 60 percent.

(continued from previous page)

all the four-letter English words ending in ZZ, type

Find ??zz

and your wish will be granted — there are six of them. The second data-compression algorithm is called run-length encoding, and it again makes use of counts. Consider the following sequence of letters

AAAAARBBSSSSWWWWWWMAAAXIIIIL

Since this sequence contains several strings of repeating characters, you can compress it very easily be replacing each repeated string by a single copy of the letter, together with a count of the number of times — the run length — it appears. The compressed version is therefore

5ARBB4S6WM3AX4IL

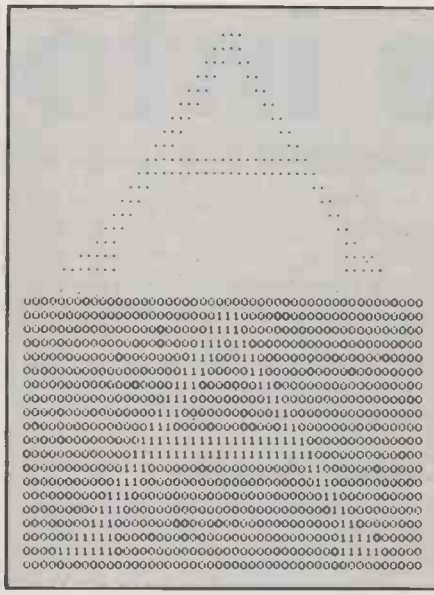
But alas, there are very few data structures in which characters obligingly repeat themselves in this way. One limited use might be in text files, where the space characters tend to come together in strings. In fact, the familiar Tab character might be thought of as a special case of run-length encoding.

However, a refined version of the technique is often used for strings of binary digits, 0s and 1s, particularly in the world of bit-mapped graphics. Here you only need to store the counts, not the actual digits, since you know they alternate between 0 and 1.

For example, a digital typesetting machine, like the one used to set the pages of *PC*, holds a number of founts — that is, sets of characters of different styles and sizes. The characters are formed from an array of dots like in a dot-matrix printer except that a much higher resolution is used. In the example shown, the letter A is formed in a 20 by 48 matrix, in which the letter itself is represented by 1s and the white space around it by 0s.

If you apply run-length encoding to this shape you end up with 65 counts. Assuming each count is held in one byte, the array can be stored in 65 bytes rather than the 120 needed to store it verbatim.

A further saving is possible by using six bits for each count. Where a count exceeds 63, which is the highest value that can be represented by six bits, you can break it into two by inserting a dummy run of the alternate digit, this run being of length zero. In the example, this would cause the first count, 71, to be replaced by 63, 0 and 8. The overall storage required would be cut to 51 bytes.



71	3		
44	4		
43	3	1	2
41	3	3	2
39	3	5	2
37	3	7	2
35	3	9	2
33	3	11	2
31	3	13	2
29	20		
27	22		
25	3	19	2
23	3	21	2
21	3	23	2
19	3	25	2
17	3	27	2
14	5	27	4
10	7	27	5
53			

The bit pattern can be represented more compactly by the above counts.

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Micros have an important role to play in financial management. In next month's special section we look at various ways they can contribute, from handling cash to accessing on-line financial services such as stock prices and BACS. We also explain in detail how to choose an accounts program.

>REVIEWS

The Sprite is claimed, by its manufacturer, to be the fastest micro in existence. We will be taking a look at Jarogate's new baby to see if it measures up to its promise. Also on the test bench is Athena, an IBM PC compatible micro better known as the Canon A-200.

CP/M for £500? Only a couple of years ago a 64K CP/M micro with a monitor would cost around £2,000. Now Amstrad is delivering disc drives and CP/M for its £239 micro, and we see how well it performs.

>AND MUCH MORE..

A micro can be used to produce titles for video films or slides. Next month the techniques are explained by Paul Kelly of the Television Literacy Project, with a listing for the BBC Micro. In our regular CP/M slot, we explain how to turn your CP/M system into a typewriter.

Our usual line-up of columns will provide lots of practical information and Sound Advice — taken literally by Mike Lewis in Software Workshop. Plus our expanded news section will tell you what is going on in the world of microcomputing.

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```
┌──────────────────────────────────────────────────────────────┐
│                    INVOICE          <0> # # # # # # # # # # # #│
├──────────────────────────────────────────────────────────────┤
│ To  # <1> # # # # # # # # # # #   From: G. W. Ltd             │
│     # <2> # # # # # # # # # # # # # # 55 Bedford Court Mans. │
│     # <3> # # # # # # # # # # # # # # Bedford Avenue         │
│     # <4> # # # # : # # # # # #      London W.C.1.            │
│     # <5> # # # # # # #              Tel: 01-636-8210         │
├──────────────────────────────────────────────────────────────┤
│ Date <6> # # /# # /# #   Tax point <7> # # /# #   Agent <8> # # #│
├──────────────────────────────────────────────────────────────┤
│ Quantity  Description                  Cost    Tax     Total │
│ <9> # # #  <10> # # # # # # # # # # # # <11> # #  <12> # #  <13> # # #│
│ <14> # #  <15> # # # # # # # # # # # # # <16> # #  <17> # #  <18> # # #│
│ and so on                                                    │
│ Total. . . . <19> # # # # # #          Tax. . . . <20> # # # #│
└──────────────────────────────────────────────────────────────┘
```

<??> items <1> to <5> internal command to request name, input, and then search an address file for details.
<??> items <6> to <7> request date input and validate.
<??> item <8> request agent number and validate range.
<??> item <9> request quantity, validate range.
<??> item <10> request description, search file, accept, and calculate fields <11> <12> <13>, if finished invoice then calculate fields <19> and <20>

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Then send fields <9> , <10> , <11> to product analysis file.
Then send fields <0>, <1>, <7>, <19>, <20> to V.A.T. file.
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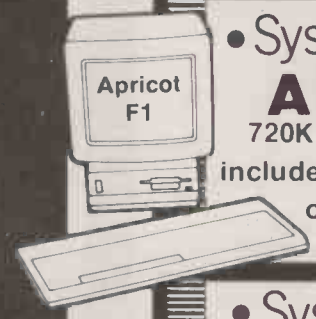

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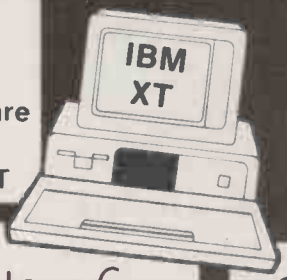

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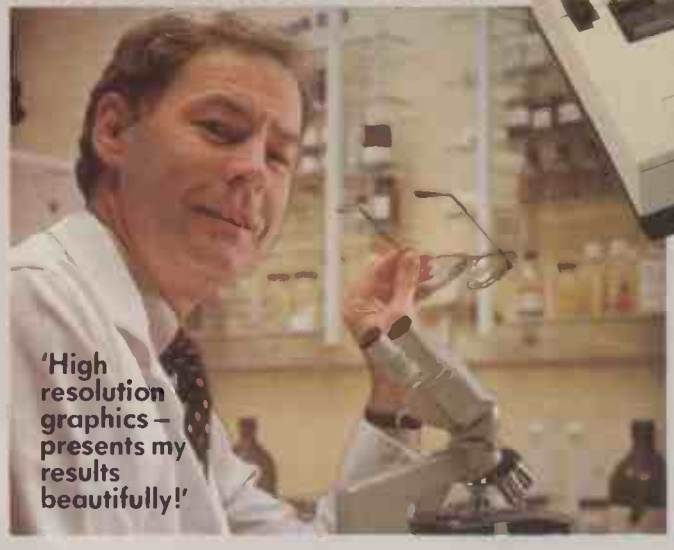

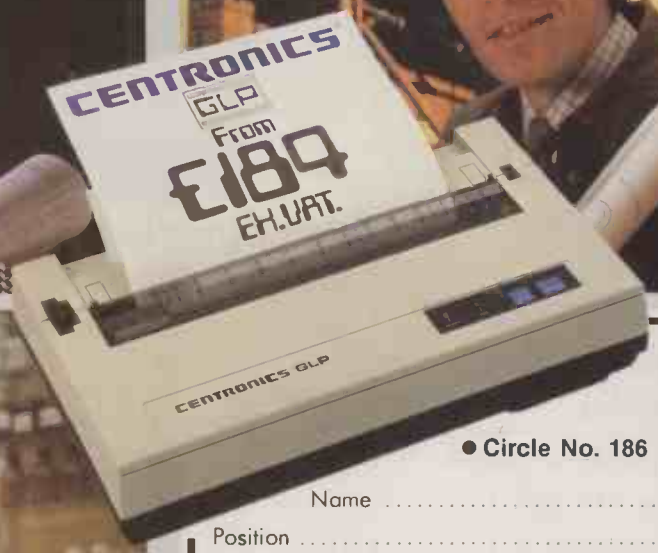

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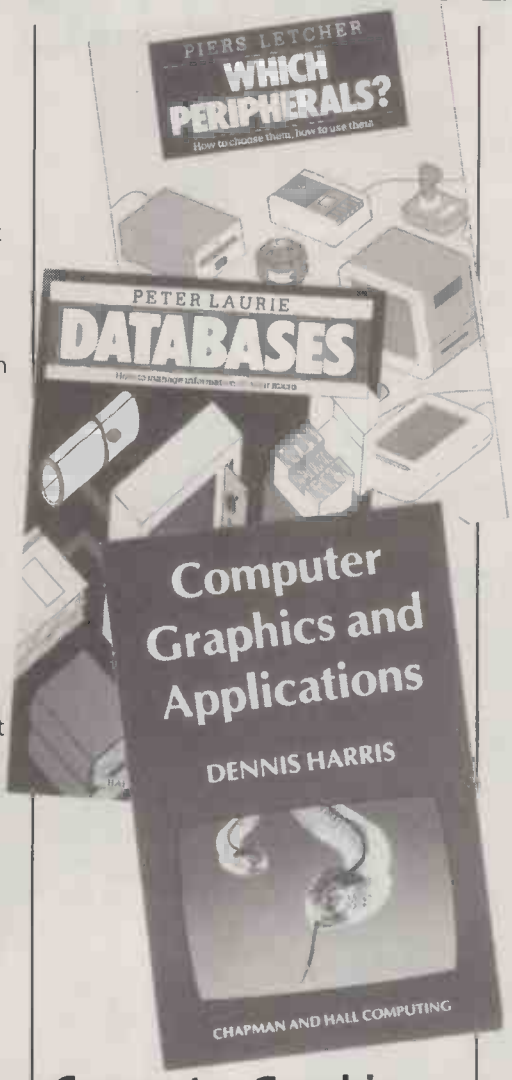

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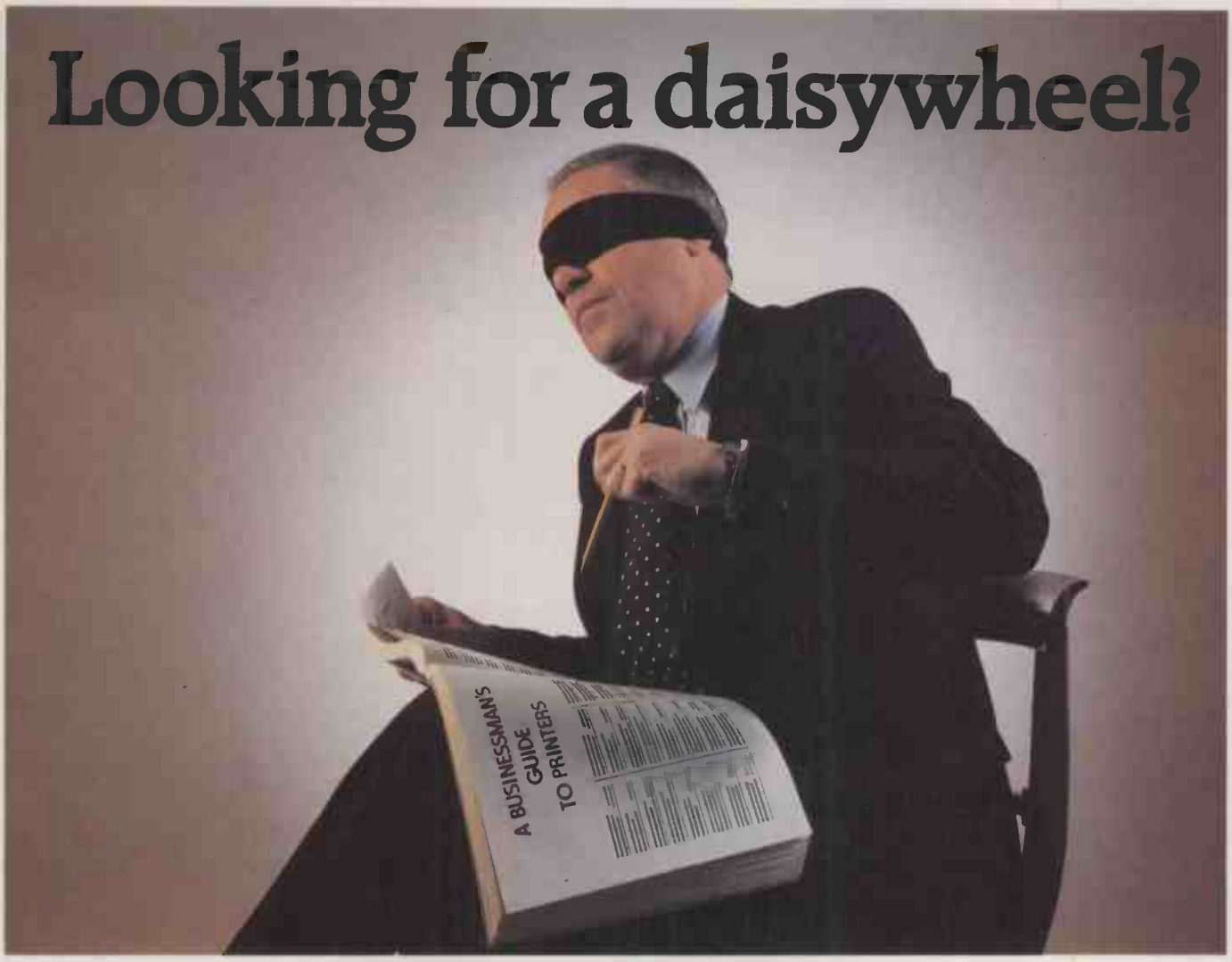

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Q Thank you for your advice in "Ask PC" about how to buy computer parts direct from the U.S., using my credit card. This I have followed exactly, and it works. I now have a different problem in that the software I purchased does not work and I want a refund. How do you suggest I do this?

J Moore

A In the November "Ask PC" we suggested that the easiest way to purchase from abroad was to write and quote your Access — called Mastercard in the U.S. — or Visa credit card number, and its expiry date. The charge for the goods is converted to sterling by the credit-card company and you eventually settle up at the end of the month in the usual way.

We recently returned some defective software to the States, which we had bought using an Access card. By the time we actually received the software, we had already paid the Access bill.

We returned the goods by air mail, together with a letter requesting a credit refund of our money on Mastercard. This is simple to do on credit-card transactions, and the company concerned sent a credit voucher to Access and a copy to us. Our next Access statement should show this sum as a credit entry.

Generally you are not likely to get a refund on software unless the disc is in the wrong format or you can prove it has a serious defect. You should always be able to get a refund on defective hardware. We wish you luck: there are obvious advantages to using a local dealer.

Q I own a Memotech MTX-512 and a Spectrum with Microdrives. I would be grateful if you would tell me if, or how, it might be possible to use the Microdrives with the Memotech.

G Wilcock

A It is most unlikely that you will get the Spectrum Microdrives to work on the Memotech. You have both hardware and software problems to overcome. On the hardware side you have to construct suitable electronics to drive the Microdrive. On the software side, programs are not stored as ASCII characters, but each line of Basic is converted in its own way, into a mixture of special characters, binary and ASCII. A line of Basic stored on the Spectrum would not be understood by the Memotech.

If you are concerned about storing programs and data on the Memotech, you will find using a proper floppy-disc unit will offer an unbelievable improvement in speed, reliability and the amount you can store compared with a Microdrive or a cassette. A floppy-disc unit is available for the Memotech RS-128, which is the later model of your MTX-512. Unfortunately, discs are expensive costing around £400.

If you want to transfer Basic programs from one machine to the other, the approach is to list the program to the printer on one machine. Whatever your computer does to Basic internally, it converts it to ASCII characters when you list to the printer. However, instead of having a printer connected you have a wire running into the other machine.

Q I am impressed by the write-up for the Amstrad CPC-464, which seems to be a very cheap method of buying a computer for both games and also more serious tasks. But does this really give access to 3,000 programs as the advertisements say? Their disc drives are 3in. whereas I though existing CP/M programs were on 5.25in. discs.

C Ervine

A The Amstrad CPC-464 is a very attractive and exciting machine offering a lot of features at a very low price. If you intend to use the computer for playing games you will enjoy the high-resolution colour graphics and the Basic in ROM, and find that the built-in cassette recorder is perfectly adequate for your needs.

To do more serious tasks you do need the £200 disc expansion unit to run CP/M. You are right to be cautious of the claimed access to 3,000 programs, which presumably refers to the number of commercially available programs that run under CP/M-80. You will require these programs to be written in the Amstrad disc format on 3in. discs, and at the moment they are not available in this format.

Amstrad may enter into agreements with the software house and supply programs for its own machine, or some other organisation may make the programs available in the Amstrad disc format. Failing this, you can buy the software on a different format of disc and get a firm like Grey Matter to copy a disc to the new format. If you have access to another computer you can use the program CPM2CPM, given in the January edition of *Practical Computing*, to copy programs from another machine. PC

Cheap WP for the IBM PC

Q I would like to use an IBM PC for serious word-processing, but cannot afford to buy WordStar. I have heard that a word-processing program like WordStar has been written in Basic, and is available quite cheaply. Can you tell me what it is called, how much it costs, and where to get it?

Shaun Milner

A You are probably referring to a word-processing package called My Word, written by Bruce Tonkin. It is sold by TNT Software Inc., 34069 Hainesville Road, Round Lake Il 60073, U.S.A., and also by Roland J Saam at Micros for Managers, 149 Gloucester Road, London SW7 4TH.

The program performs most of the functions of WordStar, and is a full-screen word processor offering the usual cursor movements, wordwrap, search and replace, deleting letters, words, lines or blocks, moving blocks, writing to and reading from files, and so on. It also has a built in mail-merge type of facility. The program was originally written in PBasic, and is sold and used as a compiled Basic program. It runs fast, and when searching through a file or printing it actually operates much faster than WordStar.

An extended version allows columns of figures to be moved, and also allows you to do arithmetic. The standard version costs $25 and the extended version $35 — both plus postage — from the U.S. The extended version costs £33.70 including VAT in the U.K. The programs only run on IBM PCs and look-alikes.

We have heard of two other cheap word processors for the IBM. One is called PC-Write, and should be available through the IBM PC Users' Group, or from PC-SIG — as mentioned in the March IBM News section of *Practical Computing*. The other is called the Nutcracker Suite and costs £43 plus VAT. It is available from Lutterworth Software, telephone (04555) 4259.

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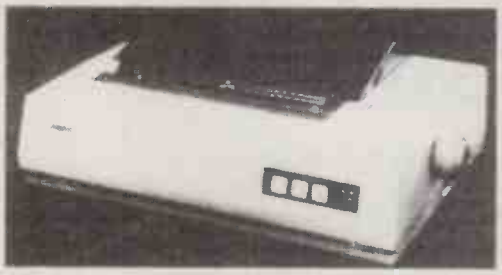

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RAMROM 15

The Sideways RAM & ROM Expansion Board for the BBC

The GCC RAMROM 15 board adds to the BBC Micro another eleven sideways ROM sockets plus the necessary hardware for sideways RAM.

FEATURES

- Fully buffered board.
- Rechargeable battery backup for RAMS provided as standard. Recharging circuitry is included.
- The board can be powered by an external 5 Volt power supply, available as an optional extra.
- The unit comes in a case of its own and resides outside the BBC Micro, giving easy access to the resident ROMS.
- For those involved in development work, most of the 6502 processor signals are made available outside the BBC Micro.
- Priority or selection can be assigned to either RAMS or ROMS.
- ROMS can be used in RAM positions simply by changing two push-on links.
- Simple installation – NO soldering.
- Can be installed together with most other BBC add-on boards.
- ZIF-sockets available as optional extras. Up to 15 may be housed on the RAMROM 15 at any one time.
- All socket positions are software selectable.
- Free Utilities Disk supplied.
- Comprehensive User Manual included.

RAMROM 15 ..... £129.95 inc VAT (P&P £3.50 inc VAT)
EXTERNAL PSU ..... £5.75 inc VAT (P&P £1.73 inc VAT
ZIFSOCKETS ..... £9.00 inc VAT Free P&P with RAMROM)

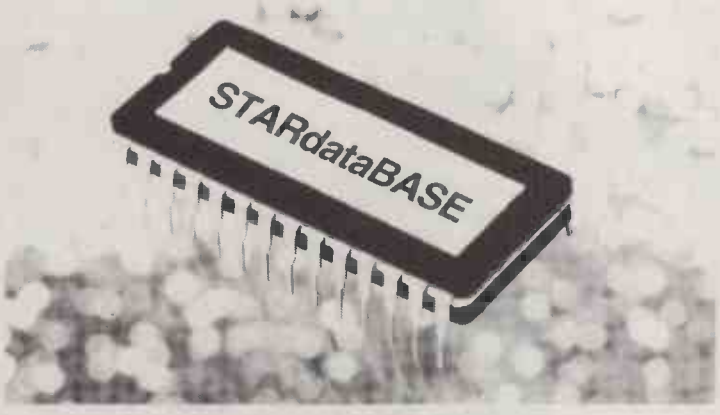
Trade and local authority enquiries welcome.
Prices correct at time of going to press.

GCC (Cambridge) Limited
66 High Street, Sawston, Cambridge CB2 4BG
Telephone: Cambridge (0223) 835330/834641
Telex: 81594 SAWCOM

● Circle No. 172

STARdataBASE . . .

The database



for the BBC

STARdataBASE is the fast, machine-code, true random access, database program in 16K ROM for the BBC Microcomputer, complete with over 75K of FREE extension Software.

FEATURES:

- Up to 4096 records in a file.
- Up to 69 fields in a record.
- Up to 255 characters in a field (subject to an overall maximum of 920 characters in a record).
- An entirely User-defined record layout, including a facility for colour.
- Can be used with 40 and 80 track Disk Drives.
- Entirely Menu-driven, extremely User-friendly.
- Extremely fast search – A single record can typically be found in 1 second using the Keysearch facility.
- Search conditions include the following: =, <>, <, >, and "Anywhere in the field".
- Powerful facilities to edit records.
- Mail-merging between documents created on Wordwise or View, and STARdataBASE records.
- Print-out of the whole database or selected Subsets, in the form of Record cards.
- Address label printing – (up to 8 across the page).
- Fully documented routines which can be included in user-written programs and interfaced with STARdataBASE.

STARdataBASE ..... £86.25 inc VAT
Post & Packing ..... £1.75 Inc VAT

Trade and local authority enquiries welcome.
Prices correct at time of going to press.

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Telex: 81594 SAWCOM

62

● Circle No. 120

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GET THEM TOGETHER

TOTAL INTEGRATION

Would you like to have your financial forecasts and your word processing produced by one simple and easy to learn computer package?
Word Result and Calc Result can get them together for you.

WORD RESULT does everything you would expect of a word processor – such as letters, memos, updates, mail merge (i.e. combining your mailing list with standard letters) – PLUS it supports eight European languages with built in hyphenation (great for international businessmen, language schools, etc.). Word Result will automatically save information whenever you stop typing – to guard against unexpected power cuts etc.

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For IBM and APRICOT

VIZAWRITE PC
WORD PROCESSING

VIZAWRITE is probably the easiest business program that you will ever use!!

Right from the start, just type onto the screen and your words are instantly laid out on the page.

Just like a professional typist, VIZAWRITE knows when to end each line so that pages are produced with neat margins, inset paragraphs and perfectly lined up tabulations.

Now you can concentrate on what you're typing, not how to type. Documents take on a new look of professionalism. Produce memos, lists, letters and complete reports with incomparable speed and ease.

VIZAWRITE can also proof-read your work, excellent at picking out those 'juggled' words that get typed when the phone rings.

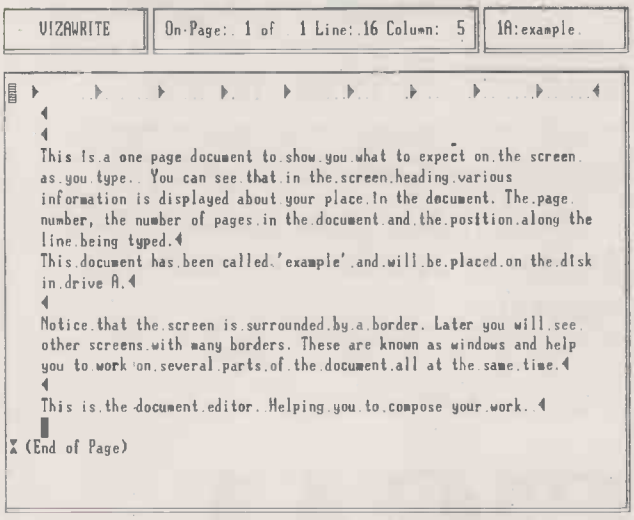
Document statistics, how many words you've typed, VIZAWRITE shows you — instantly.

VIZAWRITE is so easy to use, THE TIMES featured it again and again in no less than three separate articles on word processing for newcomers.

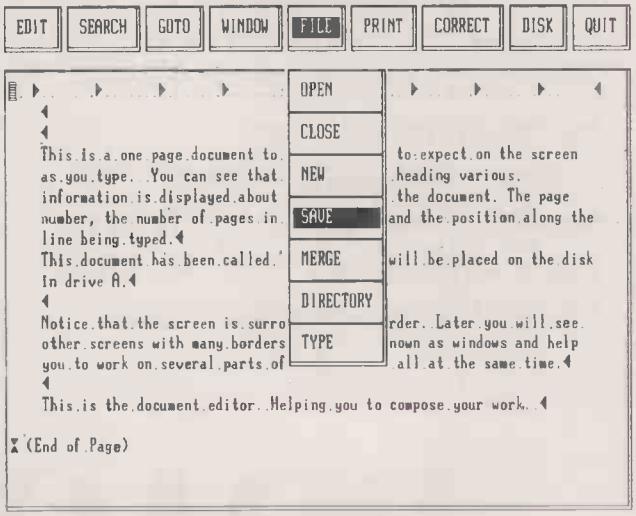
We've even included some of the latest software 'fashions', such as WINDOWS to view several documents at once, such as PULL DOWN MENUS that assist command selection, such as on-screen HELP if you can't find the manual!!... and much more.

VIZAWRITE is an extremely advanced word processing package with powerful layout and filing commands.

Remember that VIZAWRITE has achieved an ease of use that you won't find in any specification. It's intuitive, simple and fast.



The Document Editor Screen



The Command Menu

THIS WILL DO NICELY!

Now you've seen the new (and vastly improved) Practical Computing, make sure you receive it regularly every month by returning this card.

You won't want to miss what we have lined up for the future – more applications features, more on multi-user systems, more problems answered, more on communications and more viewpoints from industry leaders.

What more could you ask for? Except to receive it regularly, of course!

PRACTICAL COMPUTING

Get it regularly – send the card-today!

66

QL NEWS

News from the world of Sinclair QL computing.

The communications explosion takes shape!

Communications are now the most exciting, essential part of any computer.

In the past six months alone, over 150,000 modems have been sold in the UK.

Now, the QL's own communications explosion is taking shape . . . and it has the potential to make more of communications than any other micro!

Read on and discover exciting new ways to use your QL . . . with the QL modem . . . telephony unit . . . and powerful interface options.

67

Nº2

DAVID KARLIN

Why Q COM is everything you could wish for in communications.

The QL is now communicating – via Q COM! This exciting three-part peripheral presents QL users with a multitude of ways to exploit the world of communications.

Once connected to the QL, Q COM allows you to access the considerable number of phone-in databases, such as Prestel and QNet.

Q COM enables you to communicate with other computer users. Its facilities include electronic mail, data transfer from Microdrives and bulletin boards.

Through it you can link your QL to larger minicomputers. Q COM has full capability in this area, and allows the QL to talk to powerful mainframes.

Q COM's automatic dialling and call acceptance facilities, together with the storage of messages from other modems, will revolutionise the way you use your telephone.

The next few pages of QL News tell you much more.

It's enough for me to say here that with the QL and Q COM, you'll be exploring new openings in communications for some time to come!

David Karlin,
Chief Design Engineer.

The Q COM package

Three special parts to stack!

Q CON QL communications interface

This multi-speed interface contains the sophisticated software used to set up QL communications – and to control the Q CALL and Q MOD units.

Q CON also comes complete with Microdrive-based software. This enables the QL to link to larger computers using VT100 and viewdata protocols.

The software will also run *any* standard modem – connected via Q CON's built-in RS-232-C port.

Most importantly, Q CON allows the QL to transmit and receive at rates switchable from 75 to 9600 baud (encompassing the widely-used 75/1200 Prestel rates, and 1200/1200 half duplex rates for user-to-user exchange).

Q CON is specially styled to suit your QL – with similar fluting and ribs – and forms the base module of a vertical-stacking system.

It's supplied with full instructions, software on Microdrive cartridge, and connecting leads.

Q CALL QL auto dial/answer unit

Q CALL gives every QL user something out of the ordinary.

It's a module which links directly to your telephone, and allows auto-dialling at the push of a single key. In the same way, it will permit incoming calls to be accepted automatically . . . and even trigger pre-programmed activity from the QL!

Q CALL is the central unit of the package. It plugs directly into Q CON – so there are no connecting cables to worry about.

Q MOD QL modem

Q MOD has all the powerful facilities expected of a modem, in a neat and simple unit.

It uses either V23 75/1200 or 1200/1200 baud rates, for Prestel, Micronet 800 and all the viewdata services described alongside.

It also incorporates a telephone extension socket for manual dialling.

Q MOD is the top unit of

Q COM, and comes with a 9' built-in telephone cable.

All three units are available from Sinclair on (0276) 685311 and from selected Sinclair stockists.

The QL hooked on voice and data

The QL can now act as your personal address book and telephone operator!

Q COM allows you to store hundreds of personal or business numbers.

You can store lengthy passwords and account numbers – and recall them – at the touch of a single key.

And any information that's sent to you from other modem-owners can be gathered and stored on Microdrive cartridge, or incorporated into your QL Quill documents!

Exploring the world of QNet, Prestel, Micronet and more!

Thousands of QL users already enjoy the excitement of linking to a nationwide mainframe.

Q COM turns your QL into an intelligent terminal, allowing you to access many thousands of pages of information, software and communications facilities.

The services brought to you through Prestel can include Micronet 800, Viewfax 258 and QNet, the new QL database.

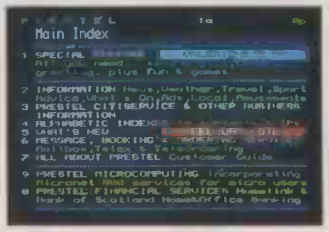
Membership of QNet will bring you free software, QL news and features, and all the wide-ranging services of viewdata!

If armchair shopping is more your style, that's easy too. It's often possible to place a direct order using your QL! For dedicated QL owners, there's a daily selection of software reviews, chart toppers... and all the facts and figures you need to make buying peripherals simple.

With Q COM you can also 'download' software from the system directly into your QL and either use it immediately, or store it on Microdrive cartridge.

In fact the only problem you'll face with a viewdata service is finding enough time to explore its many features!

You can find out how to join QNet by phoning 01-278 3143.



News... information... banking services and QNet. And only a fraction of the QL's new viewdata capability.

QL meets the mainframes!

The Q CON unit of Q COM turns your QL into a VT100 terminal, providing instant access to in-house computing services, both mainframe and mini.

Whether you are using your QL at home or at work, Q COM gives you access to electronic bulletin boards which provide help and advice 24 hours a day. You can leave messages or notices for friends or business contacts and even hold live discussions with them.

Additional benefits for the QL business user include easy access of in-house company software, and the interrogation of other data bases around the country.

There's also the opportunity of linking to British Telecom Gold – the widely-publicised and popular messaging service.

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QL Hardware

Microdrive cartridge price cut to only £1.99!

Sinclair Microdrive cartridges – up to 100K of programs and data on a medium so compact you can pop it into your pocket.

On February 1, the cost of Microdrive cartridges came down from £4.95 to £1.99 each.

Microdrive cartridges are the QL's own unique storage medium. Each stores up to 100K of information (that's 40 pages of A4 text), on a cartridge no bigger than a book of matches!

Over 500,000 cartridges are now being used throughout Britain.

You can store up to 50 different data files per cartridge, identified by titles of your own choice.

And QL Microdrives themselves are standard equipment on the new ICL One Per Desk micro, and British Telecom's new Merlin Tonto.

IEEE-488... the instrument connection

IEEE-488 is the interface standard set by the Institute of Electronic and Electrical Engineers for instrumentation control.

IEEE-488 – or General Purpose Instrumentation Bus – is a parallel interface specifically designed for high speed data transfer between a number of different types of device.

It is commonly used for controlling instrumentation via a computer, allowing the creation of laboratory data acquisition systems, industrial control schemes, etc.

The QL now has a fully-fledged IEEE-488 interface from CST. It plugs neatly into the QL's RAM expansion port, and can control up to 16 instruments simultaneously.

It's available from CST on (0223) 323302.

An IEEE-488 interface slips discreetly into place.

New inte 3½" or 5¼

With new Q-Disk, you can transform the QL into a powerful small business system – comprising QL, monitor, disk interface, twin disk drives and printer.

Q-Disk upgrades the QL to disk storage. Fitting easily into the QL's left hand RAM expansion port, without the need for a special expansion box, it contains a Western Digital disk controller chip. Software is held in an on-board EPROM (so little of the QL's RAM is used).

Plug in Q-Disk, and the QL accepts one or two disk drives, sized 3 in, 3½ in, 5¼ in, either 40 or 80 track, single or double-sided. Even when two drives are used, they can be different types!

Q-Disk offers up to 1.6 Mbytes of quick, reliable storage with a compatible disk drive.

It's made by Computamate, who also offer a full range of

QL to link students

Strathclyde University, in Glasgow, plans to have a campus network of 7,000 QLs linked to a central VAX minicomputer.

That's one QL for every student . . . a major investment project in a university which is now a leading centre for artificial intelligence work.

Sinclair is giving support worth £250,000 to the project. And it's likely that QL users everywhere will benefit – the students plan to develop AI programs to run on the QL!

The QL has impressed Prof. James Alty of the University's Computer Science Department, who says *'only the QL could offer the computing power, range of applications, and above all the portability, at a realistic price.'*

ace to connect 3½" disk drives

complimentary QL disk drives.

To contact Computamate, phone (0782) 811711.

Single disk unit fitted with 5¼ inch drives and *(inset)* the Q-Disk controller.

The QL's high-tech spec

Dimensions
138 x 46 x 472mm
(5⅜" x 1¾" x 18¾")

Weight
1388 gms (3.055 lbs)

RAM
Massive 128K standard RAM, externally expandable to 640K. Extra RAM is available in 64K, 128K, 256K and 512K units, from third-party suppliers.

ROM
48K, containing Sinclair SuperBASIC and the Sinclair Qdos operating system.

CPU
Motorola 68008 (running at 7.5 MHz) for all principal functions. (Architecturally, the 68008 is a 32-bit processor with an eight-bit data bus. One megabyte of non-segmented address space is available.)

In addition, an Intel 8049 controls the keyboard, generates the sound, and acts as an RS-232-C receiver.

Operating system
Qdos (developed by Sinclair Research) is a single-user multitasking, time-sliced system using Sinclair SuperBASIC as a command language with display handling for multiple screen windows; and device-independent input-output.

Language
Sinclair SuperBASIC, with the advantages of procedure structuring; extendability (including syntax); interpretation speed independent of program size; clean machine code interface; operating system facilities accessible from SuperBASIC; equal capability for strings and arrays; and full error-handling facilities.

Microdrives
The QL incorporates twin QL Microdrives, each with a minimum 100K capacity, 3.5 seconds average access time. Typical loading rate of machine code programs is 2-3K per second.

Video
High resolution graphics capability with colour or monochrome monitor (or TV) in two modes – 512 x 256 pixels (four colours available) and 256x256 pixels (eight colours available). Normal character display format of up to 85 x 25 with choice of character sets available (TV format of up to 40 to 60 columns depending on the software).

Keyboard
Full-size, 65-key QWERTY keyboard featuring a space bar, left- and right-hand shift keys, five function keys and four cursor control keys. The keyboard can be angled by means of detachable feet.

Expansion
Excluding RGB monitor, power socket and TV port, eight peripheral/expansion ports are provided – one internal expansion, one Microdrive expansion, one ROM cartridge, two serial and two control channels, and the local area network.

Serial
Two standard RS-232-C communications interfaces for printers, modems, etc. Transmission at rates from 75- 19200 baud or full duplex transmit/receive at seven rates up to 9600 baud.

LAN
For up to 64 QL computers. Data transmission over the net can be achieved at 100K baud.

Power supply
9V DC at 1.8A, 15.6V AC at 0.2A.

Joysticks
Provision for one or two devices for games or cursor control.

Applications Software
QL Quill – word processor
QL Abacus – spreadsheet
QL Easel – graphics
QL Archive – database
All four packages supplied with the QL.

Price
£399 including VAT, QL programs, full A4 manual, power supply, 4 blank cartridges and free Helpline service.

QL Software

Updated versions of Psion software now available!

QL Abacus, Archive, Easel and Quill are the four Psion programs supplied with every QL. They're now converted to 100% machine code, and as a result they load from Microdrive cartridge much faster.

The overlays present in Version One software have been removed, resulting in noticably quicker on-screen performance.

With the compactness of machine code, there's a big saving in QL memory too – all four programs now cope with larger, more professional applications!

Version Two software is now supplied with every new QL. Existing QLUB members – see back page.

QL·Quill

QL Quill makes it easy to type in, correct and store your letters, memos and reports.

No training is needed – a beginner can be using QL Quill for word-processing within minutes!

QL Quill has the facilities of professional word processing packages: including word wrap, search and replace, justification, page headers and footers.

QL·Easel

QL Easel allows you to create graphs, bar charts and pie charts – at the touch of a key.

The program handles anything from lines and shaded curves to overlapping or stacked bars.

QL Easel designs and scales automatically or under your control. Text can be added and altered as simply as data.

QL·Abacus

QL Abacus is a powerful, yet easy-to-use spreadsheet.

The program allows you to manipulate the contents of whole rows and columns by the names you assign them. There's no need to depend on confusing letters and numbers.

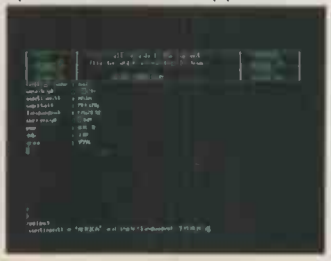
QL Abacus also incorporates a range of functions which let you carry out rapid 'what if' analyses on your data.

QL·Archive

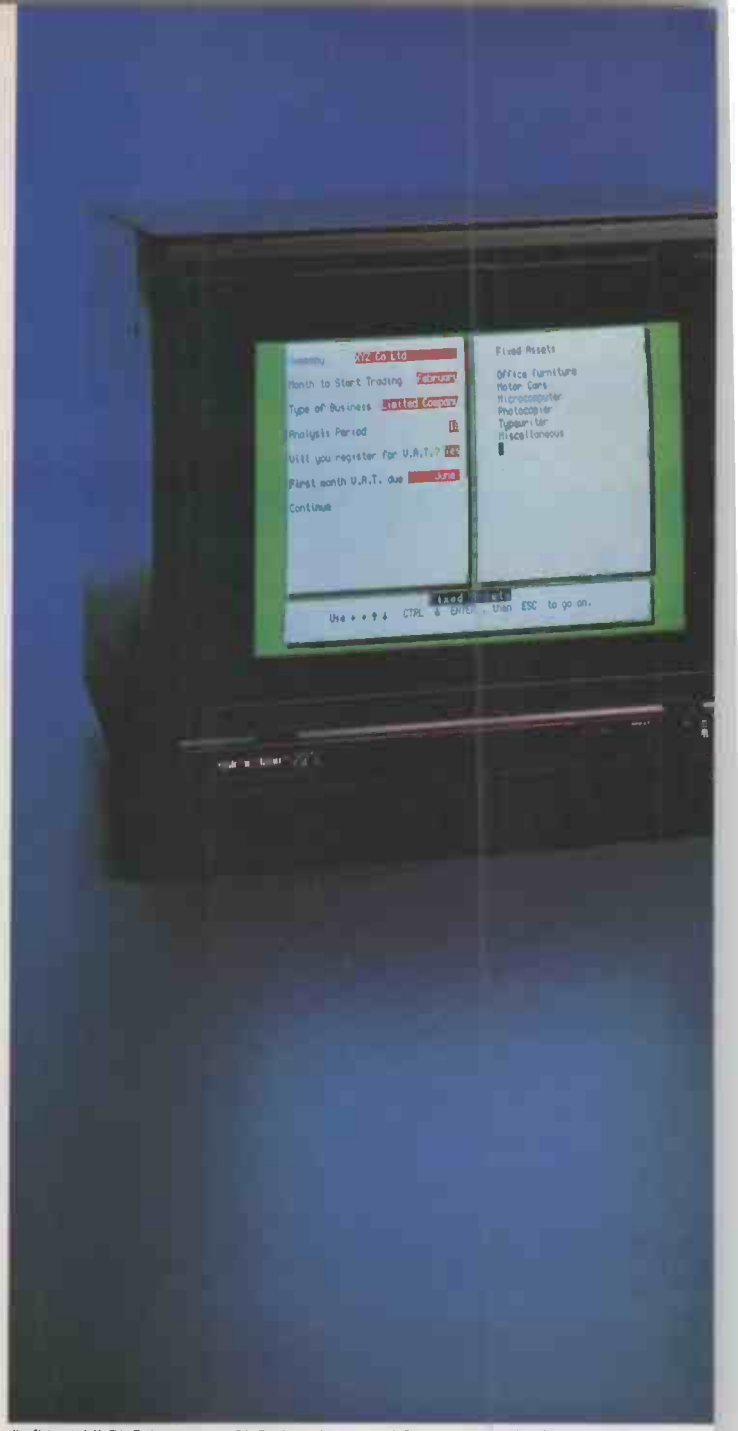
QL Archive is a sophisticated, powerful database program.

It includes a screen editor which allows you to design your own screen and format your reports, and a procedure editor which lets you tailor QL Archive to your own requirements.

QL Archive is ideal for all database uses, yet it's powerful enough to be used by many software houses to generate specific database applications.



Non-members of QLUB can purchase new versions of the above software for £15 per title, or £50 for all four programs. Phone (0276) 686100 for details.



(Left to right) QL Entrepreneur, QL Project Planner and QL Decision Maker from Sinclair.

Coming soon- QL·Entrepreneur, QL·Project Planner, QL·Decision Maker!

Three new QL business programs – with a difference!

QL Entrepreneur, QL Project Planner and QL Decision Maker train you to apply new and exciting management skills – through original and powerful means!

An interactive teaching program gives you a thorough and enjoyable understanding of each subject – backed by a text-book and 'self-test' facilities - and an applications program helps you to use your new expertise for specific problems and projects.

All three titles will increase your understanding and extend your control – making involved subjects easy, stimulating and useful!

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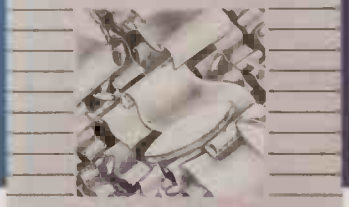
QL· Entrepreneur

Software by
Triptych Publishing Ltd

sinclair

QL· Project Planner



Software by
Triptych Publishing Ltd

sinclair

QL· Decision Maker

Software by
Triptych Publishing Ltd

QL·Entrepreneur

QL Entrepreneur is an essential program for anyone preparing to start a new business – whatever it may be!

It uses a 'question and answer' format to help you build a workable business plan.

With the input you give, it works out the break-even point of the business; the first 18 months' cash flow, the type of finance needed; the year end Balance Sheet and Profit and Loss accounts . . . and more!

QL Entrepreneur builds your skills and techniques.

It's flexible too, so that you can ask complex 'what if' questions at any stage!

The program comes with a third, blank Microdrive cartridge and a comprehensive A5 manual.

QL·Project Planner

QL Project Planner will produce plans you can understand, monitor and more easily achieve.

First, you break the project down into its individual activities, telling QL Project Planner how long each takes and which are inter-dependent.

When you decide on a starting time/date QL Project Planner will tell you when each activity must start and finish and when the project will be completed.

Each activity is divided into its critically important stages – those which can safely be moved around without altering the time taken by the project and those where movement will affect the completion deadline.

Whether or not you've used project planning systems before, you'll be amazed at the difference QL Project Planner can make.

The program comes with a third, blank Microdrive cartridge and a comprehensive A5 manual.

QL·Decision Maker

Whether you're thinking of buying a house, or taking on a new business contract, QL Decision Maker makes the choices clearer!

It lets you look at the possibilities – and their implications – through a decision tree.

Once you've set out the decisions and their probable costs or results, QL Decision Maker shows the outcomes which would occur from each particular route.

You can see how much money a decision could make for you . . . or cost you. Complex 'what if' questions are dealt with swiftly and graphically.

You can depend on the QL to highlight the best possible route!

QL Decision Maker comes with a third, blank Microdrive cartridge and a comprehensive A5 manual.

All three programs are available from Sinclair stockists, price £39.95 each, or Sinclair Research. Tel: (0276) 686100.

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Now, buy a QL and you're a member of the QLUB-free!

QLUB is the special Users Bureau for Sinclair QL owners.

Already, there are well over 10,000 QLUB members . . . enjoying a whole range of information and advisory services.

Until now, joining QLUB cost £35 per year. From March 4, every new QL owner can become a member – free of charge!

With your new QL, you'll find a post-paid form. Complete and mail it, and you'll soon be a member of the fastest growing computer club in the country.

And you'll enjoy all the helpful services listed here!

What QLUB membership offers you

Regular newsletters delivered to your door

One of the most important QLUB benefits is the special news magazine, appearing six times a year. The magazine provides a forum for QL owners to exchange views and keep in touch with all the latest developments.

Each issue is packed with updates on QL hardware and software, tips on applying the four QL programs, and news of how other people are using the QL.

Special discounts

QLUB members also receive a range of special discounts, with savings of at least 20% on selected software products.

There are also special subscription rates for Personal Computer News and QL User.

Free Helpline service from Psion

All QLUB members are entitled to 12 months special assistance from Psion.

They're at the end of the telephone to answer any questions on using the QL Abacus, Archive, Easel and Quill programs supplied with the computer.

Help is also available on any aspect of using Sinclair SuperBASIC, Qdos, or linking your QL with major peripherals.

Psion will normally answer any queries within 48 hours.

QL program updates are no longer available free to QLUB members. They will be sold separately.

Good news for existing QLUB members too!

As one of the first members of QLUB, you should already have received one *free* update of each of the four QL programs – and a letter with your new membership details.

If for any reason you haven't, you should ring (0276) 686100.

You're a QL owner, but not a QLUB member?

Then joining QLUB is easy and free! Ring (0276) 685311 for full details. You can be a full QLUB member within a few days.

Where to find the QL

The Sinclair QL is available at selected branches of Dixons, WH Smith, John Lewis Partnership, Currys, Greens in Debenhams and Ultimate, and larger branches of Boots, John Menzies and specialist computer stores nationwide.

Sinclair Research Ltd
Camberley, Surrey, GU15 3BR.
Tel: Camberley (0276) 686100.

sinclair

Can ICL make it at last? Chris Bidmead tells the sorrowful tale of a stint with the new executive work station in pride of place in his office.

As an intelligent phone, the OPD has a great deal to offer.

ONE PER DESK

ICL has placed itself centrally in the U.K. micro market, so the success or failure of the radically designed One Per Desk is important — and not just for ICL but also for the cluster of firms which could thrive from supplying software and peripherals for a successful U.K. product. ICL needs a winner badly, following the disappointing sales of its PC, the badge-engineered Rair Black Box. It therefore gives me no pleasure to report that the OPD is the most disappointing machine I have ever had to review.

I use a pair of telephone lines. The OPD's single phone is able to service both, either by using the keyboard to shuttle between the two lines, or by reserving one line for data and the other for voice. Making the connection is simply a matter of unplugging your existing telephone, and plugging a pair of standard modular jacks at the ends of two cables that run off from the OPD.

The only other connection needed is the power supply which, rather unusually, runs to the screen. A single cable carrying power and data connects the screen to the cream and chocolate coloured combined keyboard, central processor and Microdrive unit.

Small but legible

The OPD screen looks tiny beside my Cifer terminal. The Top Level Menu appears on the glare-resistant surface of the OPD screen, and as you explore the various other levels you come across a variety of character sizes, all of them shaped very like the printout from an Epson dot-matrix printer: readable but hardly elegant.

I am no fan of menu-driven software but for those who are the OPD should be enough to confirm that some aspects of software design are not a matter of taste. There is such a thing as a bad, unhelpful user interface. Choosing functions from menus quickly palls once you understand the system. If they can be disposed of and you are able to revert to the faster process of hitting function keys or control-key sequences that are easily remembered, as in WordStar, the menus can be justified as beginners' aids. This is not to advocate WordStar as the bee's knees in software ergonomics, but it does show that command sequences can be made memorable through mnemonics.

But who can remember that the four-key sequence Start 551 allows you to search the OPD's Computer Services directory? All ICL's OPD software leans heavily on menus of functions which are accessed by hitting numbers and/or function keys. The OPD's menus are not even designed to disappear: when you enter the sequences quickly enough to outstrip the menus you also use up the almost non-existent keyboard buffer.

Using numbers to select functions is particularly silly on the OPD because the numeric pad also has to double as a telephone dial, a function-key pad and a set of telephone-function controls. It therefore sends clicks down the line while the phone is off the hook. You can take special action to reattach the numeric pad to the keyboard, or use the number keys positioned along the upper row of the keyboard instead, but it all helps to add to the confusion.

There are two kinds of phone call you can make from the OPD and seperate telephone directories cater for each group. Voice calls are made by lifting the receiver and using the numeric pad to dial in the conventional way, or by calling up the directory and selecting an entry, which triggers the autodial mechanism. You can select either of the two lines to dial out on; the system defaults to line 1, which it prefers to think of as the voice line.

Line 2 is ordinarily the data line, reserved for sending and receiving text through the dual-speed — 300 baud and 1,200/75 baud — modem built into the system. Again numbers can be dialled manually or activated by a directory. The Computer Services directory needs to contain additional data about transmission speed and format — whether it is Teletype or Viewdata. This is organised by keeping a look-up table in RAM that lets you give names, called profiles, to combinations of speed and format. To simplify the process of writing call signs and passwords, the Computer Services utility lets you encode strings of characters on to key combinations.

Calls can be automatically timed and costed by reference to an internally held table of call charges, and the system will also accumulate total costs. But I found the call-timing system of doubtful use in keeping a serious record of phone charges. Once the phone has been picked up, the OPD cannot tell whether you are dialling, connected with your contact at the other end of the line or merely listening to the ringing tone. The OPD begins timing the call after about eight rings, so that even if your recipient does not respond the OPD's internal accounting already shows a debit of one call unit.

Automatic messages

The voice-response feature was also disappointing. Inside a dedicated text editor you can assemble a limited vocabulary of words to form a message to be transmitted automatically down the telephone line in response to calls received while you are

(continued on next page)

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away from your desk. This ought to be useful, particularly as you can keep a glossary of messages and send out different ones at different times of day.

Putting the messages together was simple. The software helps by offering you a list of the words the sound chip knows how to pronounce. It also allows you to enter free-form text, and highlights words that lie outside the permitted vocabulary. Unfortunately, the output from this well-designed software module is a croaking Dalek-type voice which alienated some of my callers and sent others into fits of laughter.

Callers are disconcerted by the auto voice response because of the OPD's narrow bandwidth and because they expect to be able to leave a message after the tone, as you would on an answering machine. Possibly the system would have some internal use in a large organisation, but it is not something that outside customers or contacts should be exposed to.

When I set about making voice phone calls using the directory I discovered that for all its packaging as a communications system, OPD offers no way of getting names and phone numbers across from my old Almarc CP/M crate except by re-keying manually. The voice directory is rigidly structured, offering entry fields for Name, Title, Initial and Description. There is enough room in the description field for you to make notes, but an extra Remarks field would be useful.

Talking to each other?

Psion's Xchange applications software is available on ROM as an optional extra. The Xchange database system, Archive, allows the same sort of flexibility of structure as dBase II, and would be a more suitable vehicle for the built-in phone book but for one problem. It was here that I began to glimpse the gloomy depths of ICL's software design: Archive does not know it is running on a machine with a built-in modem. It does not even know that the OPD keeps a system date. The same is true of all the Psion software, so every time you write a letter you must manually copy the date from its permanent display at the bottom line of the screen.

At this point I discovered that opening a round bracket to enter parenthetical remarks into the phone directory, or anywhere else, made the system try to send out the screen contents to the printer. This was followed shortly afterwards by a beep and the message "Printer Inoperable" since there was no printer attached. This was obviously a bug so I phoned ICL who offered to come and fix it the next day.

The bug puzzled the ICL representative. The same problem had turned up in earlier versions of the software but had been dealt with long ago. He swapped the review machine for another and left me to continue my explorations.

I ran again through the configuration routine used to set up parameters such as the printer type and what programs you want to run automatically on power-up. The configuration routines are written in Basic, which, unlike on the QL, is not standing by in ROM but has to be hauled in from one of the Microdrive cartridges. Once Basic is in place it has to fetch the main system configuration menu, and it appears the process from start to finish takes three and a half minutes.

Remembering that the OPD is supposed to be a multi-tasking machine, I thought I would spend the time it takes to get into the configuration menu doing something else. So while Config was loading I hit the Start key to go back to the opening menu, and from there branched to the Xchange package to enter Quill, the Psion word processor.

I had written five words of notes when the word processor died with an "Out of memory" message. On returning to Config I found that Basic was having the same problem. Both routines had choked each other to death and I could find no way of recovering either program. I had to go into the Housekeeping routine, delete both from memory and start all over again. So much for multi-tasking.

I had to revise my feelings about the OPD's multi-tasking a couple of times during the course of the trials. The aspects of multi-tasking that work are certainly a persuasive argument against the plodding one-job-at-a-time approach of the more expensive IBM PC. If you have two tasks on the go — say, a word-processing task in Xchange and the saving to cartridge of a telephone directory — then the Resume key will toggle betwen the two. If more than two tasks are running, the Resume key gives you a menu of them and lets you pick the one you want to activate.

The literature claims that up to eight tasks can be run simultaneously. This claim is justified if the tasks are small and carefully chosen. But in everyday use two problems arise: some of the ICL software is not written to run alongside anything else, and memory constraints are rather tight.

If you are in the middle of updating your telephone directory and need to break off to see some details in a Quill file, you might expect to be able to move a section of text simply and easily from the word processor to the telephone directory. In fact, you can't. More seriously, when you return to the telephone directory by hitting Resume, you find you have dropped back on to the main menu. If you climb up into the phone directory again by hitting Start 12, you discover that your partial entry has gone, together with the details you have already entered.

The OPD's 128K of RAM sounds generous by the standards of a BBC Micro or a CP/M-80 machine but it is a tight constraint on a more ambitious operating system. First, the screen takes up a quarter of the memory even if you are only working in monochrome. The operating system grabs another 16K, leaving a user space of approximately 80K. This has to be shared between program and data because the philosophy of the OPD is only to use the slow Microdrives as end-of-day backup. A further invasion on the space is that the Xchange suite grabs 22K of RAM every time you activate it.

Yet another limitation is that memory becomes fragmented as blocks are allocated and erased in the course of running

Above: Sinclair ULAs are prominent on the ICL-designed main board.
Below: The Xchange ROM cartridge.

Specification

CPU: Motorola 68008
Memory: 128K RAM with 32K used for screen; 2K battery-backed CMOS RAM for system parameters; 144K to 352K of ROM containing systems software, OPD Basic and applications programs
Keyboard: 73-key QWERTY including telephone-style numeric keypad
Display: 9in. monochrome or 14in. colour screen
Sound: TI 5220 speech synthesiser with 152-word vocabulary in ROM
Cassette: two built-in 100K Sinclair Microdrives
Interfaces: RS-232 printer port, as Sinclair QL
Modem: BT-approved autodial/autoanswer
Dimensions: control unit is 440mm. (17.3in.) by 250mm. (9.8in.) by 95mm. (3.7in.); weight, 3kg. (6.6lb.)
Price: monochrome version on £1,195; colour version £1,625; Xchange £130 extra
Supplier: International Computers Ltd, ICL House, London SW15 1SW. Telephone: 01-788 7272

Screen, keyboard and Microdrives

The ICL software divides off the bottom three lines of the screen as a noticeboard area, where the time, date and aspects of the system status can be posted. Several intensities are displayed: two shades of grey in 80-character mode and six shades in 40-character mode; with the colour monitor they appear as separate colours. Some of the lower intensities are not easy to read. Unlike the excellent Olivetti M-24 monochrome monitor there is no easily-got-at contrast adjustment to compensate for this, and all you have is brightness control. The screen automatically turns off if you stop using it for 10 minutes or so. Hitting any key turns it on again instantly.

The keyboard is bright and responsive, and I found it very nice to type on, despite the eccentric layout. The standard typewriter keys are brown. There is no colour distinction between these and the control key or OPD special keys like Start, Resume and Recall, which are used for switching between tasks. The cursor keys, also brown, are split on either side of the space bar, which I found distinctly annoying.

The Escape key is also brown but unlike most computer keyboards it does not have the key-top to itself. Instead it is Shifted above the asterisk key that is part of the numeric keypad. There is another asterisk shifted above the 8 at the top of the keyboard so there is no lack of choice. The awkward two-finger access to the Escape is far from handy when it is so frequently used as the get-out key throughout the whole Psion package.

The numeric keypad is red and has the function keys mapped on to it, the Alt key being used to shift between the two. In conjunction with the Shift key the numeric keypad is also used to drive some of the telephone functions, and somehow the Caps Lock has got mixed in there too. There is one bright green key on the keyboard, Enter. This is unfortunately the same size as an ordinary character key, but it is within comfortable reach of the home keys — one up on the IBM PC — so touch-typists should adapt easily.

The two Microdrives perch over the keyboard in a housing that looks like a large bar of Toblerone. The system calls them L: and R:, standing for Left and Right. Memory is also treated as a file-storing device called M:. This is a great improvement on the long-winded MDV1 format that the QL insists on. However, when you power-up what is supposedly ICL Basic — and is in fact a minor revamping of Sinclair's excellent SuperBasic — the drives revert to their full QL names and the concept of M: disappears.

different processes, and the operating system has no automatic mechanism for rescuing isolated slivers. The only way to crunch memory is to save everything to tape and restore it again.

The result of this is that as long as you are not doing anything else and you are not trying to save any other files in memory you can reckon that Quill will throw in the towel with an out-of-memory message at around 5,000 words, so you can almost write a 10-page report single-spaced.

Long waits

It is possible to extend this size by over-riding the default that makes Xchange store its files in memory, so larger jobs can be tackled if really necessary. However, you will have to put up with long waits during saving and loading because Microdrive activity takes over the machine entirely.

I also found that, as on the QL, Quill sometimes gets into a twist offering a message like

```
Unable to start Quill
Press Space to continue
Press Esc to abandon Quill
```

Pressing Space simply repeats the error message, and abandoning Quill is the only course of action. Even this is not enough as Quill's data area in memory is damaged and the only way to repair it is to abandon the whole Psion package and reactivate it.

Quill on the OPD is strictly a glass-typewriter word processor: that is, simple to get to grips with but inadequate for extensive text editing. I cannot help feeling these are still early days for games house Psion in its venture into serious software, for the whole package has some very curious shortcomings that betray this inexperience. For example, there seems to be no way to make a copy of a portion of text in Quill and send it out to another file.

I decided reluctantly that I would have to go back to my old machine to write this review, and was presented with the task of transferring the couple of pages of notes I had already gathered together in Quill. I felt confident that I would be able to transfer the text to a familiar environment should the need arise, presuming that if the worst came to the worst I could always send the text down to Telecom Gold over the built-in modem and retrieve it again on the other machine.

However, the worst did come to the worst because as with the telephone directory, the OPD offers no help in uploading or downloading data from another machine. So I turned to the modem link. I was flabbergasted to discover that there is no way of transmitting text created in Quill over the modem, and that it is equally impossible to use Quill to edit text received in the same way.

In the end I got the notes across, using some RS-232 jiggery-pokery to pretend to the OPD that the Almarc was a printer. It was none too soon. Later that afternoon I discovered the screen was displaying an attractive flickering pattern like psychedelic wallpaper. Something had zapped the RAM. Both telephone lines had died, and the RAM data, the telephone directories and the last traces of my review notes had all evaporated.

Conclusions

● As an intelligent phone the OPD has a great deal to offer. Voice contact is highly automated, and the best features of the system work well. Connection with such widely differing systems as The Source and Prestel is simply a matter of menu selection.

● ICL makes much of the multi-tasking capability, but this turns out to be strictly limited. Memory can be a problem: of the 128K theoretically available, 32K is reserved for the screen and further large inroads are made during use.

● Design limitations on the multi-tasking are curiously set. For example, if the phone rings while you are formatting a tape, the format is instantly abandoned. I kept running into design and memory limitations on the multi-tasking that left the OPD with no significant advantage over single-tasking implementations of the Xchange suite.

● The overall software ergonomics are dismal. Psion's contribution on this front is moderate but not inspired. ICL's numerically selected menus betray a mainframe mentality that the company will have to shake off if it wants to stay in the micro market.

● Psion's software and ICL's software seem to have been written on different planets, from the point of view of both function and ergonomics. It's a pity that Psion's database and spreadsheet cannot call on the system date. It is astonishing that Quill has absolutely no access to the data transmitted and received over the modem.

● The basic project is a sound design idea and a promising marketing proposition. The formidable list of shortcomings that currently severely limits the use of the machine can be whittled down, given the will and effort from the ICL team. PC

TANDY 1000

Has the universal computer arrived? Jack Schofield discovers that Tandy's cheap, colour IBM compatible may be coming close.

THERE ARE THREE main reasons why the Tandy 1000 is important. It is IBM PC compatible. It is cheap: prices start at well under £1,500. And it will be sold in High Street shops, not in the slightly intimidating specialist dealers.

In the 1000, Tandy has produced a truly universal computer. Not only does it outperform many of the micros currently used in large corporations and small businesses, it is ideal for the one-person business and for business/home use.

It can become a major contender in this market, as it will be sold through Tandy's own High Street computer stores. While many ordinary people may be overawed by specialist computer dealers' shops, no one is scared of going into Tandy.

The 1000 is largely compatible with the standard IBM PC. There will undoubtedly be many badly behaved packages that it does not run, but it does run the Microsoft Flight Simulator, Lotus 1-2-3, Multiplan and other popular programs.

Joystick and colour

Unlike ordinary IBMulators, the Tandy is also designed to be largely compatible with the IBM PC Junior. Thus it has built-in colour graphics and other extras such as a light-pen port and two joystick ports. This means it can run the very large range of IBM PC games and educational programs, including most of the American Top 30

However, many users will find that most of their needs are satisfied by Deskmate, the integrated software package supplied free with the Tandy 1000. Deskmate offers word processing, a spreadsheet, a filing program, telecommunications and a calendar/diary program on a single disc. It will be reviewed in depth next month.

The Tandy 1000 is built in Fort Worth, Texas, and a U.S. production sample was supplied for this review. There is no reason to believe U.K. machines will be substantially different.

In appearance, the 1000 is very like the well-known Tandy 2000, but much smaller. In the basic version the 1000 has two parts: a system box with a Teac 5.25in. floppy-disc drive, and a keyboard. You have to add either a colour or monochrome monitor. You can have a second built-in disc drive, and one was fitted to the review machine.

The system box contains a single board with 128K of RAM and an Intel 8088 CPU. It has a keyboard port, two joystick ports and a red Reset button on the front. There are ports for a parallel printer — actually, this is just an edge connector — a light-pen, RGB monitor, and composite video/audio output on the back. There is no RS-232C port, so it will require an extra expansion card from Tandy if you want to add a modem.

No parity checking

Removing the top of the case reveals the motherboard, which is mostly hidden under the well-shielded disc-drive enclosure. However, it includes both the colour-graphics and floppy-disc controller circuitry, both of which are on separate expansion cards in the IBM PC itself. There is apparently no 8087 co-processor socket, and no sign of either a DIL switch or a DMA chip. The memory is made up of 16 64Kbit RAM chips, with no ninth row of chips for parity checking as on the IBM.

The main board has three free expansion slots, claimed to be IBM compatible. The system box is too short to take standard 14in. IBM cards, so clearly the compatibility is limited. The review sample had a Tandy-made RAM expansion card already fitted. This had several interesting features: it had 128K of RAM soldered directly to the board, plus sockets for a further 128K; it also had a DMA chip to speed up memory access with larger amounts of RAM.

The single-board construction obviously reduces cost at the expense of flexibility. Dropping the IBM's parity checking is another obvious cost-cutting measure. That said, the quality of the design and construction appears to be very high.

The keyboard is the one part of the Tandy 1000 that causes alarm. It is just not the same as the IBM PC version. It has more keys, and many of them are in different places. There are 12 function keys instead of 10, and four separate keys for cursor control.

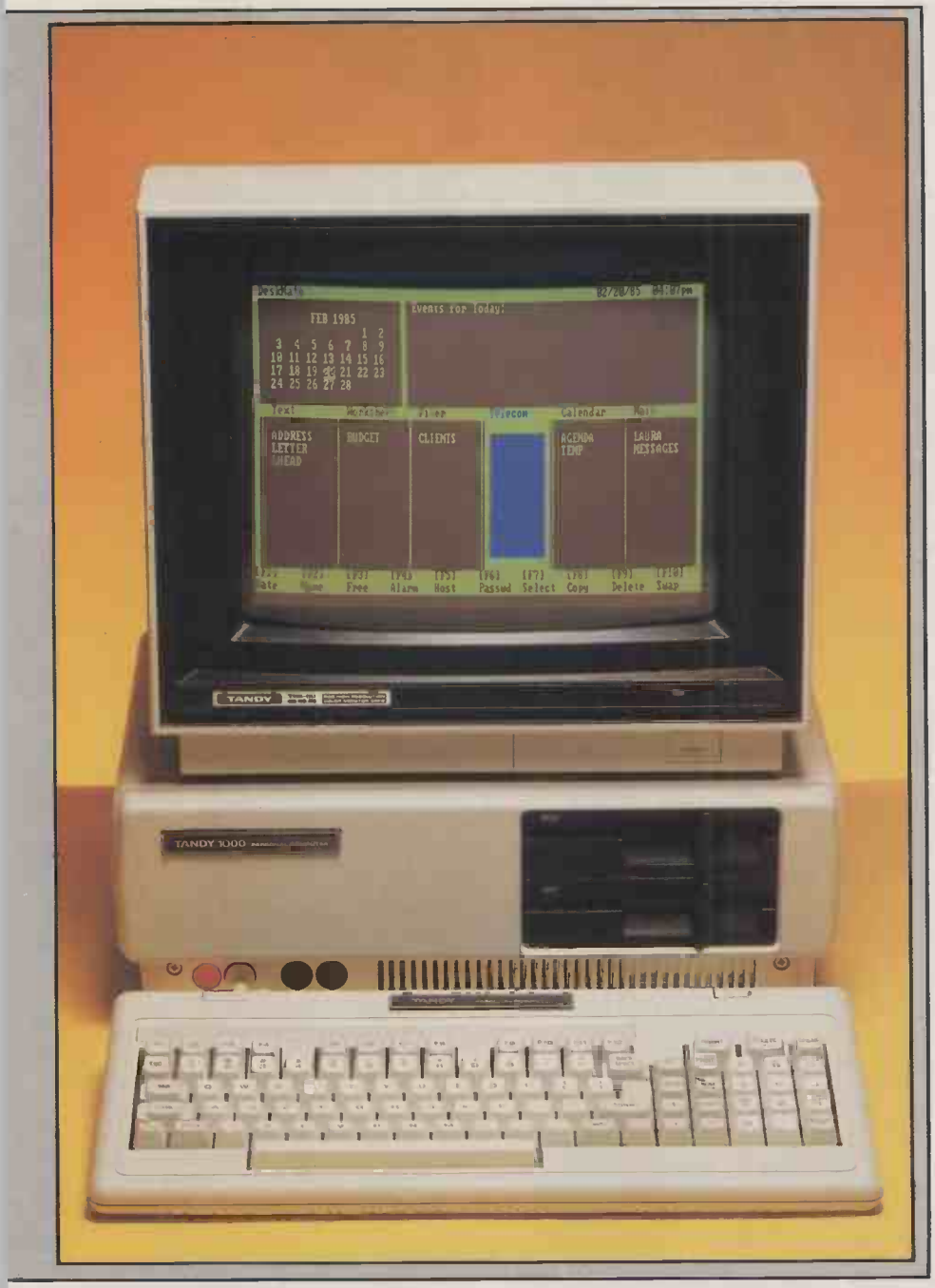
Some changes represent minor improvements. The Caps Lock key has been resited, and given an LED; the Backslash key has been moved from its ill-conceived position between the left Shift and Z. Also,

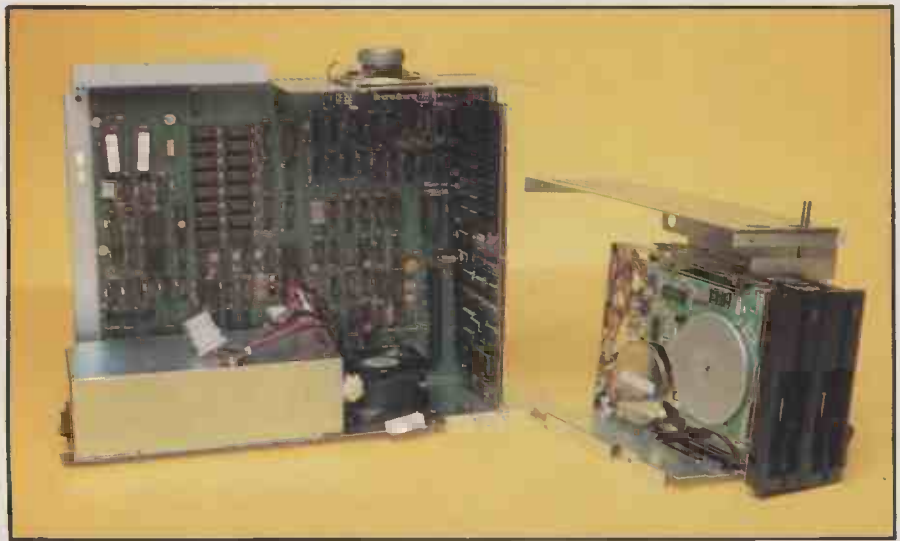
Specification

CPU: Intel 8088
RAM: 128K, expandable to 640K
ROM: 16K
Storage: 360K disc drive
Keyboard: 90-key detached with numeric keypad, 12 function keys, four cursor keys; LEDs on Num Lock and Caps Lock keys
Sound: one voice via internal loudspeaker; three voices via external speaker
Interfaces: RGB and composite video, parallel printer port, light-pen port, two DIN-plug joystick ports
Expansion: three IBM PC compatible expansion slots, limited in length
Software in price: MS-DOS, GWBasic, Deskmate integrated software
Dimensions: 415mm. (16.3in.) by 335mm. (13.1in.) by 150mm. (5.9in.)
Price: single-floppy system with keyboard, £1,099; monochrome screen, £159; colour monitor £499; second disc drive, £269; all prices exclude VAT
Supplier: Tandy, Tameway Tower, Bridge Street, Walsall, West Midlands. Telephone: (0922) 648181
Availability: U.K. deliveries scheduled for the end of April

Screen mode options

Mode	Colours	Resolution	Text width	RAM used
0	16	80 x 25	40 or 80	2K or 4K
1	4	320 x 200	40	16K
2	2	640 x 200	80	16K
3	16	160 x 200	20	16K
4	4	320 x 200	40	16K
5	16	320 x 200	40	32K
6	16	640 x 200	80	32K





Inside the machine virtually all the components fit onto a single large motherboard.

the keyboard plugs into the front of the system box, instead of the back.

As the IBM PC keyboard is software definable, rather than hard-wired, there is no real reason why the IBM PC layout should be followed exactly. However, the Tandy 1000 keyboard clearly looks, feels and is different. With some packages this may reduce the level of IBM PC compatibility. The alphanumeric keys seem to be the same, but who can tell what effect function keys f11 and f12 will have in packages not designed to use them?

Keys feel good

In absolute terms, however, the Tandy 1000 keyboard is very good. The keys are sculpted and properly sprung, and a touch-typist is likely to prefer them to many other compatibles.

There is 32K of video RAM, though only the two 16-colour higher resolution screen modes actually use all of it. The standard character set is identical to the extended ASCII of the IBM PC.

No problems were encountered running a small selection of software from IBM PC discs, although the Microsoft Flight Simulator and Sidekick would only produce monochrome. Lotus 1-2-3 ran happily in colour, and ignored f11 and f12. TK!Solver also ignored the keys; Multiplan recognised them but responded firmly with "illegal option".

The 1000 started the IBM PC diagnostics disc, though it could only find 240K of the 256K of RAM installed, and never actually got to any of the diagnostics routines. This suggests that, in the end, the 1000 will prove adequately IBM PC compatible, rather than outstandingly so.

Inferior display

Unlike the best compatibles, such as the Olivetti and Compaq models, the Tandy 1000 does not provide a combined monochrome/colour screen display. In fact it does not offer the equivalent of the IBM's green screen at all, just the equivalent of the colour-graphics adaptor. The point is that the IBM provides exceptionally good stability and legibility on the monochrome screen. At the lower resolution of the colour display the characters are not very tightly formed, and this is how the Tandy displays all text.

The Tandy 1000 has many advantages over the IBM PC, and it provides more for a lot less money. It certainly has the edge over the normal IBM PC in providing colour-graphics facilities. However, for intensive word processing or spreadsheet use the less fatiguing display of the IBM green screen takes a lot of beating.

For many people this factor may not be decisive, and this is where the Deskmate software might tip the balance. Good integrated packages commonly cost from £200 to £500, and the fact that it is included with the machine makes the 1000 an attractive proposition. Just how good the software is we will be investigating next month. PC

WYSE PC

Compact, elegant and thoroughly compatible — what more could anyone want from an IBMulator? Robert Piper puts this handsome 8088-based desk-top machine through its paces.

IBM PC COMPATIBLES do little to raise the blood pressure these days, and a new machine needs some special claim to fame if it is to turn any heads. In the case of the Wyse PC the company has chosen to package the machine in a box little thicker than the average software manual. It is an impressive feat of engineering, but unfortunately the slimness of the case does little to improve the machine's overall ergonomics. The unit is so low that with the keyboard placed on the desk in front of the main box access to the disc drives is impeded.

The review machine was an almost "full-house" colour version with 10Mbyte hard disc and 512K RAM. The Seagate hard disc is mounted to the right of an Epson 360K floppy drive of the type fitted with a rather cumbersome locking button. A totally unprotected on/off rocker switch is also rather foolishly on the front, where the rear edge of the keyboard could easily knock it into the Off position

On the rear panel the cooling fan outlet, mains sockets and other interfaces are tidily arranged. An auxiliary supply for the monitor is included, so only one mains cable is required. The Wyse is well endowed with interfaces: in addition to the monochrome connection, the standard machine has two RS-232C ports and one parallel port. This is a far better spec than the IBM, where even a single RS-232 port is an extra. The only criticism is that the parallel port is fitted with a non-standard socket.

Well laid-out inside

The Wyse is manufactured in Taiwan, but it would be a mistake to assume that it is of second-rate construction. The reverse is true, a fact which becomes apparent immediately the robust case is removed. Although there is not a lot of room the internals are beautifully finished and well laid-out. The power supply occupies one-quarter of the machine on the right-hand side, and the motherboard takes up all the remaining space on the base plate. Above the motherboard are the disc drives and expansion chassis.

It is rather sad to have to report that the Wyse only uses the standard Intel 8088 CPU running at the same conservative 4.77MHz as the IBM. It does seem like a missed opportunity not to have opted for the full 8086, or at least an 8088-2 running at a faster speed. The standard Wyse is supplied with 256K of RAM, which can be expanded to 512K without using up either of the precious expansion slots.

One of the penalties of the Wyse's trendy low-profile design is that expansion is rather awkward. The expansion cards have to lie flat over the motherboard, so there is only room for two slots on the basic machine. The hard-disc colour model has no vacant slots, as the hard-disc controller and colour/graphics card consume a slot each.

Wyse tackles the problem by offering a multi-function backplane which not only increases the total memory to 512K but also adds a real-time clock with battery backup. For £320 you can also buy a separate four-slot expansion unit which connects to an expansion-bus controller card occupying one slot in the main unit. For a net gain of three slots this does seem an unecessarily cumbersome and expensive way of expanding a system. The expansion unit is designed to sit under the main processor box, which does give the added bonus of raising the disc-drive slots to a more practical position. The Wyse can be fitted with the Intel 8087 arithmetic co-processor, if required.

The keyboard closely follows the IBM layout, with one commendable exception: the three function, QWERTY and numeric keypads have been separated by about 15mm. Unfortunately the Wyse also perpetuates some bad aspects of the IBM keyboard. There are no LED indicators on the Num and Caps Lock keys and no separate entry key for the numeric pad. There is a robust tilt bar which can be flipped out to raise the rear edge of the keyboard if required. I found the key action acceptable, but it does not have the same substantial feel as the IBM.

Futuristic looks

A striking appearance has now become something of a trademark for the Wyse monitors. They boast a very futuristic, angular look which makes them seem a lot less bulky than they actually are. Both the monochrome and colour monitors adopt the same philosophy in their design and feature 14in. screens instead of the more conventional 12in. variety.

A tilt/swivel base, which costs an extra £21, fits into an off-centre retaining recess on the top of the PC box. A single edge-wise brightness control is cleverly concealed on the lower right-hand corner of the sceen bezel. Wyse monitors are interchangeable with IBM versions and offer a very similar performance. Text appears a little grainy, but this is more by virtue of the larger display than any intrinsic hardware fault. Sitting further from the screen should get round this problem. Colour, graphics and screen-update performance are all up to the IBM standard.

The MS-DOS version 2.11 supplied with the Wyse is very much a standard implementation which includes all the usual utilities and no extras. Rather strangely, however, the DiskCopy command does not format as well; this operation has to be

(continued on page 82)

Specification

CPU: Intel 8088 running at 4.77MHz
RAM: 256K expandable to 640K
ROM: 8K ROM bootstrap and diagnostics
Dimensions: system unit 476mm. (18.75in.) by 368mm. (14.5In.) by 63.5mm (2.5in.)
Keyboard: 83-key IBM layout, 10 function keys
Mass storage: two 5.25in. 360K floppies, or one 10Mbyte hard disc plus one 360K floppy
Interfaces: two RS-232C serial, one parallel
Prices: with dual 256K floppy discs, £1,925; one floppy and 10Mbyte hard disc, £3,400; monochrome monitor, £250; colour monitor and card, £795; backplane extension, £465; expansion chassis, £320; all prices exclude VAT
Manufacturer: Wyse Technology, 3040 North First Street, San Jose, Callfornia
U.K. distributor: RTS Technology Ltd, Unlt 12, St. Pancras Commercial Centre, 63 Pratt Street, LondonNW1 0BY. Telephone: 01-267 7541

Basic Benchmarks

The table shows the time in seconds to run the standard Basic routines — see *Practical Computing*, January 1984, page 102. WIth the same CPU as the IBM PC, the Wyse PC Is just slightly faster.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Wyse PC — 8088	1.3	4.7	10.2	10.5	11.4	20.4	31.8	33.8	15.5
IBM PC/AT — 80286	0.5	1.9	4.6	4.7	5.2	9.1	14.6	13.5	6.8
Olivetti M-24 — 8086	0.5	2.0	4.6	4.7	5.2	9.4	14.8	16.1	7.2
IBM PC — 8088	1.3	4.8	11.8	12.2	13.4	23.6	37.6	36.6	17.7

Above: The Wyse PC shown running standard IBM versions of Lotus 1-2-3 and Sidekick. The screen fits into a recess which is offset to the left; the free area on the right is where the power supply is sited internally.

Right: Inside the Wyse PC. The power supply and fan are on the far left, and the hard disc in the middle over the main board. Accessory cards, which would normally be upright and run front-to-back, here lie flat and run from side to side. The topmost card is the colour-graphics adaptor, which feeds the video signal out of the side of the system box. Ports on the back are: power point for monitor, monochrome display, Centronics printer, two RS-232C and keyboard.

Bagshaw Benchmarks

The table shows the time in seconds to run 14 Benchmarks designed by Eric Bagshaw of the National Computing Centre to show the speed of loading programs and making disc accesses — see *Personal Computer World*, November 1984, page 180. The three machines here were all tested using the 10Mbyte hard discs fitted.

	BM0	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	BM10	BM11	BM12	BM13	Total	Rank
Wyse PC	20	9	10	15	3	20	10	25	11	5	6	76	44	13	267	3
Apricot XI	16	6	7	11	7	26	1	27	2	4	9	50	20	6	192	1
IBM PC/XT	19	5	19	15	3	22	8	27	8	3	3	76	31	15	254	2

(continued from page 80)
carried out separately. There are also some limitations on the use of the Mode command, but they are unlikely to trouble many users.

Microsoft's GWBasic interpreter is included on the system disc. As well as GWBasic itself there is a batch file called Basica, which simply calls up GWBasic, so that any calls IBM software may make for Basica can be met.

The first aspect of the Wyse you are likely to notice is the amount of noise it makes. The diminutive fan, the floppy drive and hard discs all contribute to the din, but whether it will still be audible above the general mayhem of the average office environment is doubtful.

To all intents and purposes, the Wyse PC performs just like an IBM PC. The Basic Benchmark tests BM1 to BM8 average out to 15.5 seconds, which is marginally faster than the IBM. The time taken reading and writing to disc is likely to be of more serious significance in practice so we also ran the Bagshaw Disc Benchmarks. In these tests the Wyse turned in a performance which was to all intents and purposes identical to the IBM PC/XT's. The Apricot XI is significantly faster than both of them, romping home in around 190 seconds.

Compatibility with IBM software is excellent. The Wyse PC ran every package we tried without any problems. Even some of the more sophisticated packages with complex copy protection loaded up and ran without any difficulties. The only problem we encountered was with Microsoft Word version 1.1, which loaded and ran as normal but displayed a rather strange border around the text-entry screen.

Prospective customers can choose any package intended for use on the IBM confident that there will be no niggling compatibility problems. Wyse itself has compiled a list of 250 packages tested on its PC. They include famous names like WordStar, Lotus 1-2-3 and Symphony, dBase II and VisiCalc.

The Wyse PC will be distributed and supported in the U.K. by RTS Technology. The warranty period is a mere 90 days — hardly competitive in this day and age of reliable electronics.

Two double A5-format manuals are provided: a combined user guide and operating-system guide, and a separate GWBasic reference manual. The user manual is divided into eight sections covering every aspect of operation from "Getting Started" to "Systems Error Messages". There are several appendices, one of which gives some honest guidance on potential compatibility limitations. Coverage is good, but the manuals would have been improved by being bound more robustly. The GWBasic manual is best considered a reference book, although chapter 1 does deal with the rudiments of programming.

The drive slots are so low down that the keyboard inhibits access.

Conclusions

● As an IBM PC look-alike the Wyse PC is hard to fault. It is pleasing to look at and well made, and is compatible to a high degree with the IBM machine. Documentation is above average.

● The low-profile processor box looks superb but detracts from the functional efficiency of the machine. Access to the disc drives is restricted and hardware expansion is made more expensive than it is with more conventionaly designed machines.

● It is regrettable that a faster processor has not been built into such a latecomer to the PC-compatible market. There are now faster machines which offer equal levels of compatibility at a similar price to the Wyse. PC

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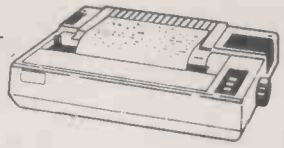

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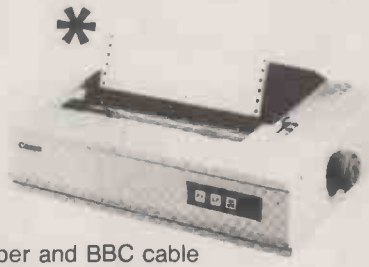

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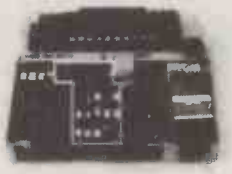

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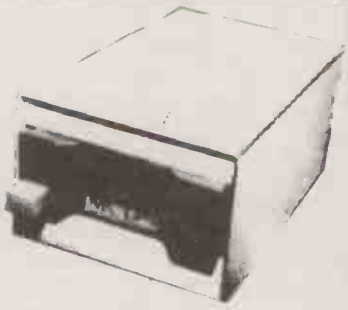

The Micro disc drive offers a method of low cost quick access to programs. The drive is essentially a small version of a 5¼" disc drive and offers similar features to the larger drive.
The data is stored on a 3" disc, this is enclosed in a protective hard plastic cassette which features a write protect switch.
The micro drive requires the standard Acorn disc interface, but a new disc filing system rom. Acorn DFS may be exchanged for the micro DFS for £2.30. The new micro disc filing system can read and write to Acorn DFS discs.
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BBC

The most famous name in word processing is now attached to a new product for the IBM PC. With so many competing programs now available, Roger Cullis assesses the newcomer's chances of living up to its predecessor.

WORDSTAR 2000

MICROPRO HAS TAKEN a leaf out of the detergent manufacturers' book. Although the name on the package stays the same, the new, improved automatic word processor inside is a completely different product.

WordStar dates from the days when computers were not endowed with large memories, and so it was designed to use the minimum amount of RAM. Modules such as Help screens were kept on disc and loaded in as overlays when required. The result was painfully slow, and you waited for what seemed like years for the computer to complete its disc accesses. Another difficulty was that WordStar was hard to learn, since every operation involved you having to press a multiplicity of keys.

Neither of these shortcomings prevented WordStar becoming a runaway success. Over 1.25 million copies have been sold worldwide, and maybe four or five times as many pirate copies are in circulation. Like other authors of a successful package, Micropro has had to tread a careful path between the devil and the deep blue sea: to choose between frequent and major updates which keep it abreast of the latest developments, or to maintain the uniformity and freedom from change beloved of dealers and end-users. In the past Micropro has opted firmly for stability.

New features

In WordStar 2000 it has produced an entirely new word processor. The aim has been to keep all WordStar's best features and to add new ones where required. It is written from scratch in C on a Unix-based system. This approach should facilitate porting to new processors, but WordStar 2000 has so far only been implemented on the IBM PC. Old-fashioned WordStar will continue to be sold alongside the new product for this machine as well as for the eight-bit micros for which WordStar 2000 is not available.

WordStar 2000 comes in a bulky package which includes four manuals entitled *Installation Guide, Getting Started, Training Guide* and *Reference Guide;* their respective thicknesses form a Fibonacci series, each one being approximately equal to the sum of its two predecessors. There are six discs: Installation, Program, Dictionary, Conversion and two Tutorials — the last so that you do not have to read the four manuals.

The spiral-bound manuals themselves are clearly written and well presented, with strategic use of bold printing and rubrics to make them easy to follow. You also get a plastic overlay to clip on to the keyboard of your PC to remind you of the default settings for the various function keys.

Most of the discs can be readily duplicated. The program disc has a built-in counter which only allows you to make three copies, but this is not a serious limitation since you can recover the copy and reset the counter if your working disc wears out. It does mean, however, that you cannot transfer the program to a RAM disc to gain enhanced operating speed.

Installation is a simple two-part procedure, requiring eight blank formatted discs or alternatively 2.1Mbyte of hard-disc space. First, you make backups of discs 2 to 6 using the normal DOS Copy program. Then you insert disc 1 in drive A and type

ins-1 floppy

or

ins-1 hard

according to your disc system configuration. After this you simply follow the on-screen instructions.

After your working copies have been made, the second part of the installation process sets up the default system configuration. This enables you to choose colour or monochrome displays and set up the features of a graphics card. Printers can be chosen from a wide list and you can select features such as alternative founts, print colour and pitch.

Only one printer driver can be accommodated on the program disc, so you cannot easily use, for example, a dot-matrix for drafts and a daisywheel for the final copy. An Advanced Modifications

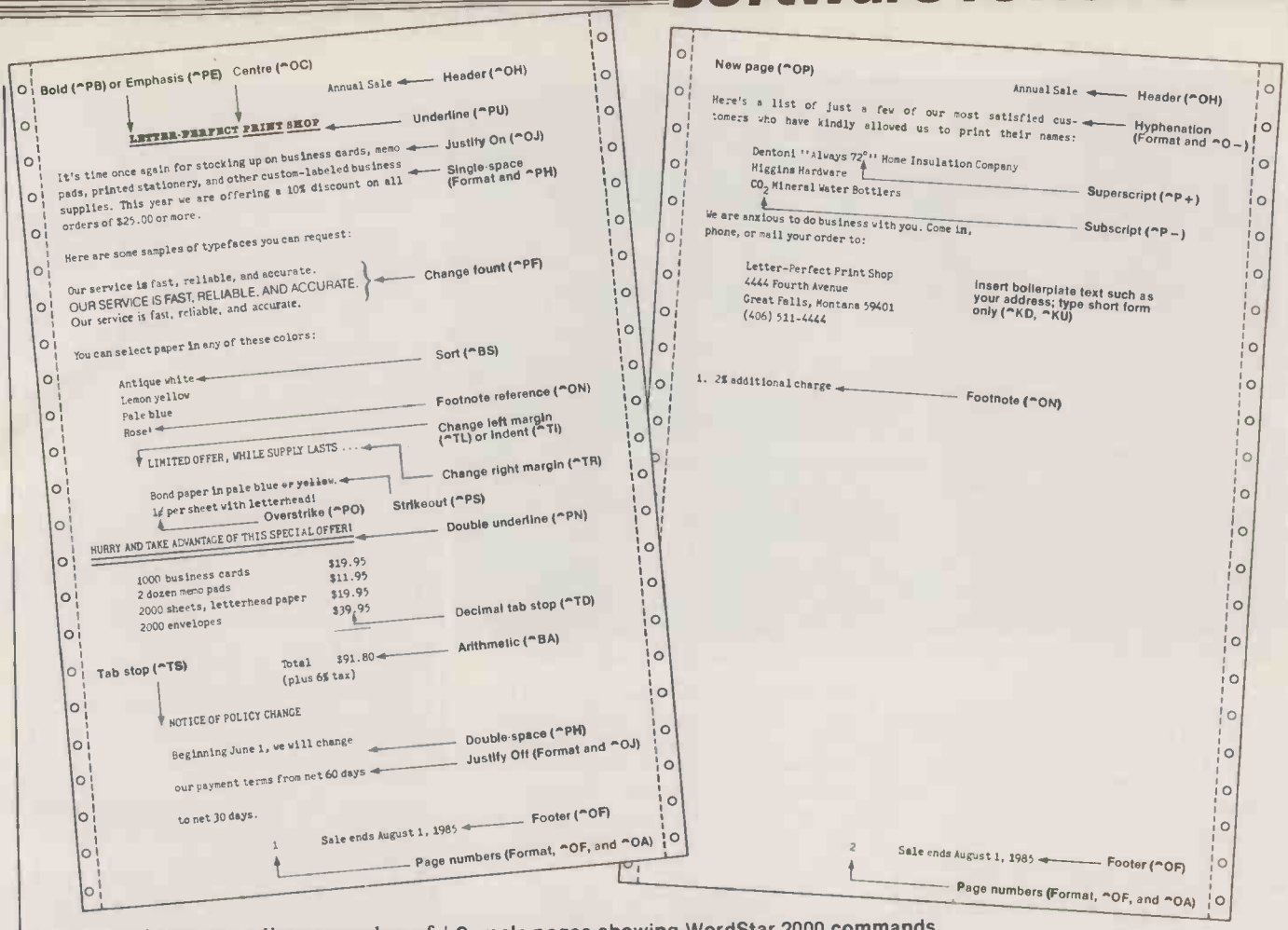
Specification

WORDSTAR 2000
Maximum file size: 8,192,000 bytes
Number of lines that can be sorted: 150
Right margin: cols 10-240
Left margin: cols 1-70
Lines per page: 3-500
Maximum number of characters in locate/replace string: 40
Maximum number of founts: 8

CORRECTSTAR
Main dictionary: over 65,000 words; 310,912 bytes
Personal dictionary: up to 1,500 words
Maximum word length: 32 characters

MAILMERGE
Maximum variable length: 31 characters
Maximum file size: 8,192,000 bytes
Number of files you can chain print: unlimited

SYSTEM REQUIREMENT
Operating system: PC-DOS v.2.0, 2.1 or 3.0
Memory: 256K
Discs: two, at least 360K each



Sample pages showing WordStar 2000 commands.

phase permits you to adjust a number of WordStar 2000's default settings, and lets you do things like reprogramming the function keys. All the installation is menu driven — a far cry from the original WordStar, which required you to be expert in assembler to set up even relatively minor modifications.

Five formats

Starting up is simple: type WS2 to boot WordStar 2000, E for Edit when the opening menu is displayed, and away you go. Following normal conventions file names consist of eight characters plus extension. For each file, you can choose one of five formats: justify, memoform, manuscript, normal or ragged. Alternatively you can design your own for the specific application. The advantage of coupling a format with a file is that next time you come to edit it no time need be spent on setting items such as tabs and margins. Format files are set up by answering a standard series of questions about the top margin setting, lines per page, line spacing, etc.

Text may be entered in either Insert and Overtype mode. Cursor movement is achieved either by using the cursor keys or Ctrl-C — C for cursor — followed by a mnemonic character: B, beginning; E, end; H, home; L, left; R, right; T, to specified character. Deletion also follows this convention. Ctrl-R, for remove, is followed by similar mnemonic characters. The cursor can also be moved to a specified page number..

A major new editing command, Crtl-U for Undo, permits you to reverse the previous deletion and replace the characters removed. Fast typists will find this invaluable. When the session is finished, the prepared text is saved by Ctrl-Q for quit.

The screen display commences with a status line which shows the editing command currently in use; the name of the file you are editing; the page, line and column number of the cursor; Insert/Overtype option setting; and vertical/horizontal arithmetic mode setting. The menu area shows the possible choices of action. Below this, instructions tell you how to use the menu. A ruler line shows the margins and tab stops, and a flag column at the far right of the screen contains an entry-type indicator — end of paragraph, end of text, page break, etc. Your text appears in a window; up to three may be in use at any one time.

Not WYSIWYG

Unlike WordStar, where what you see is what you get, WordStar 2000 always displays text with a ragged right-hand margin. I hesitate to say that I can see the justification for this, but it does have the advantage that you can see where you have put hard spaces. A serious shortcoming is that, if you are not using a 10 character/inch printer the text does not match up with the ruler line.

One of WordStar 2000's powerful features is its ability to manipulate blocks of text which are marked with

Ctrl-B B

at the beginning and

Ctrl-B E

at the end. A marked block can be moved or copied to another location, or removed or written to a file. In addition, an existing file can be read in as a block to the cursor position. This can be very useful if you want to read in skeleton text for modification. The block transfer can be reversed with the Undo command.

Another feature of the block commands is the ability to sort and to carry out elementary mathematical operations. To commence sorting, WordStar 2000 is set in the Block Vertical mode with a

Ctrl-B V

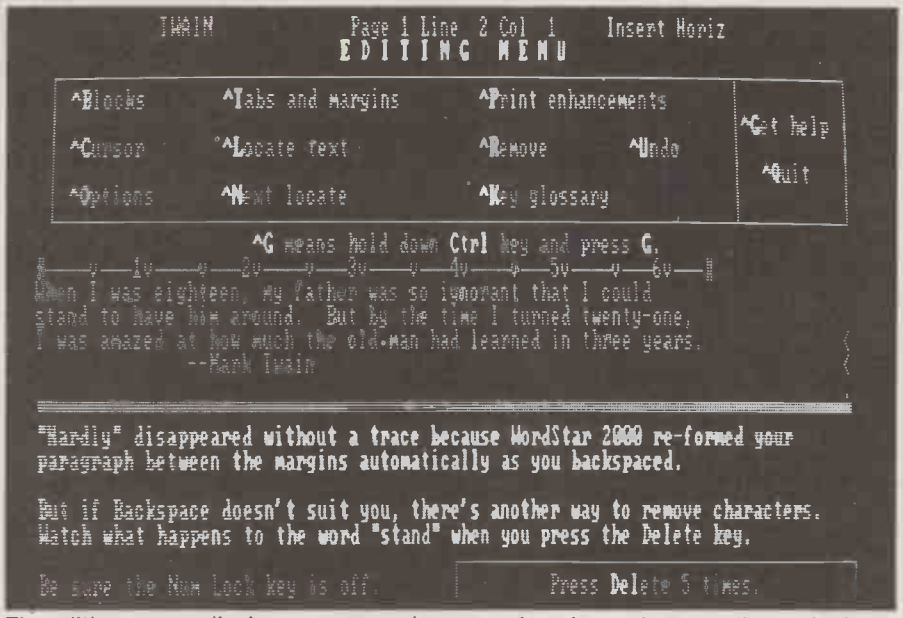
command. The block is marked with standard block markers. A Block Sort command

Ctrl-B S

is issued and, depending on whether an A or D command follows, the lines within the block are sorted in ascending or descending ASCII order. For arithmetic, the appropriate symbol is added to the text, the default operation being addition. A decimal tab can be selected for currency calculations.

With an appropriate printer, commands may be embedded in the text to change the printing characteristics. Bold, underlining, subscript, superscript, strikeout,

(continued on next page)



The editing screen displays a command menu and a ruler to show margins and tabs.

(continued from previous page)

emphasis, line spacing, typeface, ribbon colour and paper trays are features which may be selected. Selected words such as a title or a proper name may be linked together so that they always print on the same line.

The format file associated with an editing file when it is created carries the initial setting of margins and tab stops, but they may be reset in the body of the document. The ruler line display which shows their positions acts like a command tag for any other change in the text, such as the insertion of a superscript. Indents may be created and text may be typed in columns. On-screen formatting is instantaneous if the margins are changed.

Key glossary

For text which includes regularly used groups of words an abbreviated version may be used by constructing a key glossary which contains the corresponding long and short forms. The glossaries are stored in key files, each of which may contain up to 20 key definitions. A long form may include up to 560 characters and the corresponding short form from one to 15 characters.

WordStar 2000 includes a Typewriter mode, in which keystrokes are immediately echoed at the printer. This feature is useful for envelopes or filling in forms.

WordStar has always had the ability to spool printer output by allocating part of the available memory for this purpose. With much more memory now available, the opportunity presents itself to edit more than one document simultaneously or simply to display text for information. By using windows, WordStar 2000 permits you, for example, to type new figures into a spreadsheet, extract figures from another document, look up page numbers, or move paragraphs from a first draft to a reorganised second draft.

Only the document in the window with the cursor may be edited, but the cursor can readily be moved from window to window. If you wish, more than one window may be opened in a single document, but the same limitations on editing applies. Text may be moved from one window to another using the block move facility.

You can mark pages with headers and footers, which may include page numbers if you wish. You can create a footnote at will. WordStar 2000 prints the footnote number in superscript in the text and the footnotes in consecutive order at the end of the text. On the screen the number is highlighted or coloured.

You can create forms by adding text to a format file, and it will be offered as an option with the other formats in the opening menu. Text may be typed in two ways, depending on how the form is to be used. One way is to leave adequate space for information to be typed, the other is to mark the blanks with a character and to type the information in Insert mode.

WordStar 2000 comes with Correctstar, a powerful spelling checker. Its 65,000-word dictionary is offered with English as well as American options. Individual words may be checked during an editing session, and when Correctstar finds a mistake it will suggest an alternative. You can check the spelling of a paragraph or the entire document, or if you have only changed a part of a document you can instruct Correctstar to bypass the remainder. The default dictionary can be supplemented by an extra personal dictionary which may contain names or technical terms.

Mailmerge is a feature of WordStar 2000 that lets you create master documents which can be used for a variety of printing tasks. It produces personalised form letters by taking information from various sources such as data files, operator input or other text files. You can use it to print two or more files consecutively to create a continuous document, like the chapters of a book. You can produce a mailing list with alternative versions of a form letter, selecting your data according to preset criteria.

Compared with WordStar...

New features

Remove a sentence or paragraph without defining it as a block
Restore the previous alteration
Use preset formats, embed ruler lines
Use up to three windows in the same or different files
Mnemonic commands
Pre-programmed function keys
Short-form entry of key terms
Go directly to specified page
Perform simple arithmetic
Sort blocks of numerals or text
Typewriter mode
Automatic reformatting when you change margin settings
Boldface and underline screen display
Underline between words
One-command indenting of both margins
Add footnotes
Use up to eight type founts
Select page-numbering position
Select paper trays
Select print enhancements

Exchanging files

WordStar 2000 has an automatic facility to convert WordStar files to the new format. It goes through the file, changing commands it recognises to the equivalent WordStar 2000 command. Dot commands which have no equivalents, and other WordStar commands not translated, are flagged with explanatory comments. To complete the conversion it is necessary to go through the file, removing these flagged comments and making any further changes manually. A similar program is provided to change WordStar 2000 files to WordStar format.

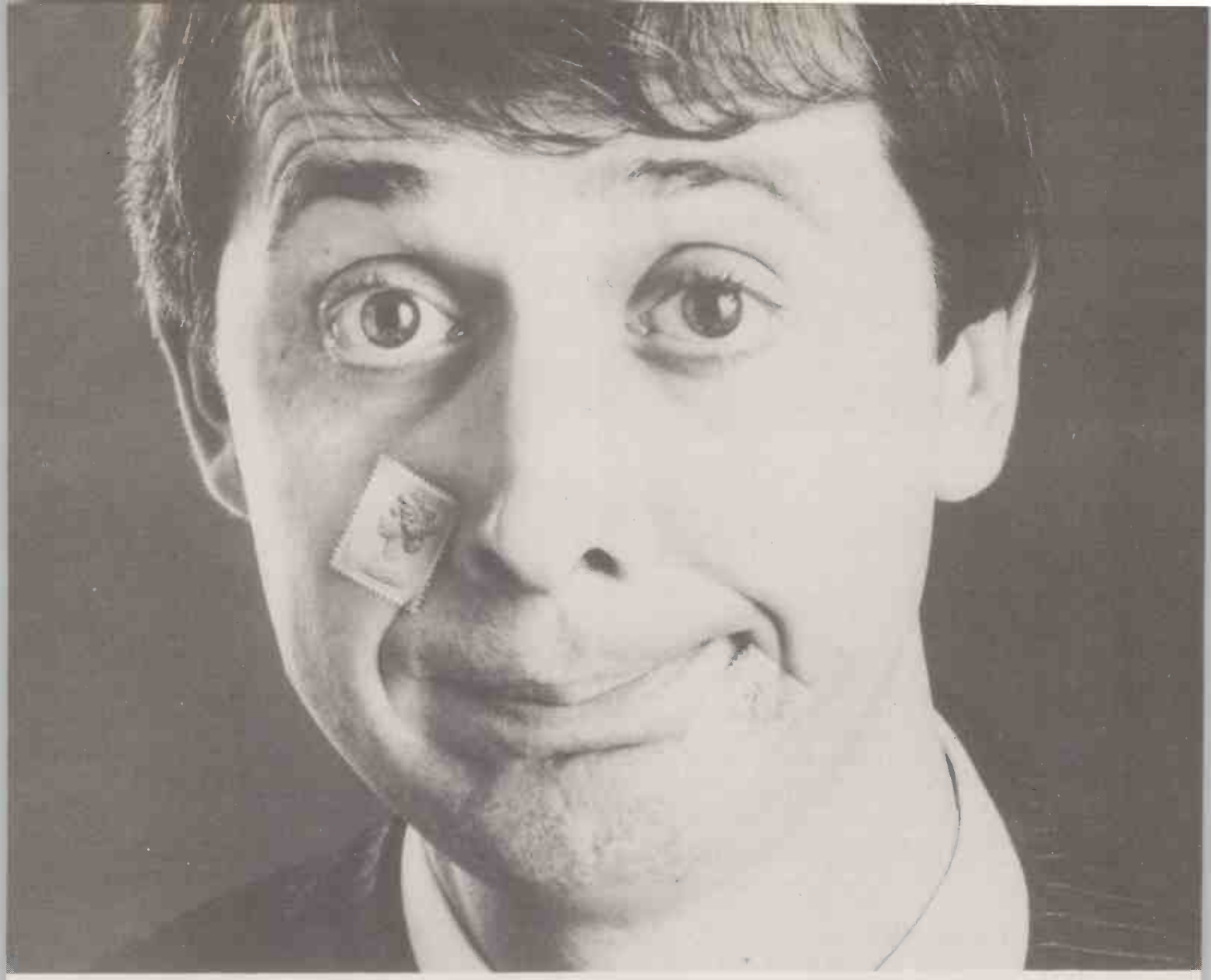
Conclusions

● WordStar 2000 is not WordStar — both the command set and the file structure are different. But like the original product it does a lot — it is a very complete word processor.

● At present WordStar 2000 runs only on the IBM PC and close look-alikes. It is easy to install and makes good use of the IBM function keys.

● Compared to other modern word processors running on the IBM PC WordStar 2000 is really not that exceptional. But Micropro has done as competent a job for 16-bit word processing as the original product did for eight-bit. It is probably enough to say that I liked it and would use it myself.

● WordStar 2000 costs £440 plus VAT. It is distributed by Micropro, Haygarth House, 28-31 High Street, London SW19 5BY. Telephone: 01-879 1122. PC



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dBase II lives on

Users of Ashton-Tate's established database package will continue to be well supported by third-party products, as Mike Lewis discovers.

WHEN Ashton-Tate released dBase III last year, a minor shock wave hit the dBase community. If, as seemed likely, the new product was to be the definitive database package for the years ahead, what would happen to the vast investment in dBase II applications and systems? Many thousands of newcomers to computing had struggled to master dBase II, and few of them could have relished the prospect of starting again with a new, incompatible language, however superior it might be. Worse, the new product was to be available to the MS-DOS and PC-DOS world only. Would the army of CP/M-80 users be left in the cold?

To find the answers to these questions, I have been talking to Ashton-Tate and taking a look at the sub-industry that has grown up in the shadow of dBase II. If the entrepreneurs and authors who flood the market with dBase add-ons, training aids, books and consultancy services are anything to judge by, there is still considerable faith in the future of the original dBase II. What is more, the people at Ashton-Tate's HQ are bending over backwards to reassure customers of their continuing support.

dBase II compiler

Perhaps the most exciting development of recent months has come from a small software house called Wordtech Systems. The company has answered the prayers of system developers by releasing the first-ever compiler for dBase II. This alone is certain to keep the language at the forefront of its field for a long time yet.

With dB/Compiler, dBase programmers can convert their applications directly to an executable form and then run them independently of dBase. This immediately gives rise to three main benefits, although there is a major snag too.

The first benefit is speed. In any programming environment, a compiled program will nearly always run faster than an interpreted one. This is because the time-consuming work of decoding the source program is done once only, during compilation, rather than each time the program is used. In Basic, it is not unusual for a program to run 20 times faster once it has been compiled.

Although the speed-up produced by dB/Compiler is less dramatic, you can still expect a healthy improvement in running times. Moreover, the compilation process is pretty quick, and you can compile and link an entire application — command files, report forms, format files and so on — in one pass.

I have compiled over 50 dBase programs and in most cases have found improvements of 25 percent to 50 percent. Large, complex programs seem to give the greatest savings. The main problem area is with tasks involving heavy computation, where compiled programs run only slightly faster, and in some cases slower, than the originals. This is partly because dB/Compiler performs all arithmetic to 30 decimal places, against 10 in dBase II. However this is not likely to cause too many difficulties because database applications do not usually involve extensive calculations.

You have to balance such time savings against a possible increase in space. With 16-bit versions of the compiler, the minimum size of an executable suite of progams is 90.6K, consisting of a fixed-length root module and two overlays. In eight-bit environments the root is smaller but there is more overlay swapping. This arrangement works to your advantage if you have a large suite of integrated programs but it makes the compiler less attractive for small, free-standing command files.

The second benefit of dB/Compiler is confidentiality. A software house can distribute copies of its work without worrying abut prying eyes discovering its secrets. Admittedly, previously they could achieve the same end by using Ashton-Tate's Runtime. This crunches dBase code to an unrecognisable form, but means spending £65 on a Runtime licence for each copy of the application sold.

And so to the third of the benefits: price. Once the software house has laid out £675 for dB/Compiler, it has no further royalties to pay and there is no need for it to supply its customers with dBase itself or a Runtime licence. Consequently off-the-shelf dBase applications are more attractive, which benefits the entire dBase community.

The major snag for software developers relates to copy protection. Every time you invoke dB/Compiler in a 16-bit environment you must do so from the original floppy disc on which it was supplied. You can then remove this disc and

dB/Compiler timings

Programs in dBase II will run much faster once they have been compiled with dB/Compiler, but the extent of the speed-up varies considerably from one type of program to another. In general, complex programs working on large databases appear to do well, especially if they involve heavy string manipulations. Routines with extensive calculations fare less well. Here are some typical timings in seconds, all of which were carried out on an Olivetti M-24, with floppy discs, under MS-DOS.

T1. Update a database of 150 records and four fields. For each record calculate the square root of one of the fields, a two-digit integer, by iterative methods — five iterations — and place the result in another field. Display all values on the screen.
T2. Update a database of 10 records and two fields. For each record, generate a Simplex code of one of the fields — 30 characters — and place the result in the other field. Display both fields on the screen.
T3. Update a file of 150 records and 16 fields. For each record, calculate the mean of two fields and place the result in a third. Test the values of substrings of four fields and store the result as a logical value in a further field.

It takes dBase II and dB/Compiler 45 seconds to compile all of the above routines as a set of linked command files, and 56 seconds to link the above routines — this increases slightly with the size of the programs. The total size of the source files is 1,500 bytes, to which approximately 72K should be added for dBase II itself.
The total size of the executable file and overlays is 93K.

	T1	T2	T3
dBase II	50	32	78
dB/Compiler	41	21	43

dSort timings

The following show how much faster the free-standing dSort program runs compared to the built-in Sort and Index commands. In each case, the database being sorted had 114 records, each of which was 207 bytes. The key field was 25 bytes. All tests were performed on a Superbrain with floppy discs; the timings in seconds do not include program invocation.

dBase internal sort command	115
dBase internal index command	80
dSort program	35

continue with a working copy, but if the original becomes worn or damaged you are well and truly stuck. I am fully alive to the arguments for anti-piracy measures, and I only mildly object to copy protection of luxury programs like spelling checkers. But if a software house commits itself to dB/Compiler, the product will be its bread and butter, and it will have to think very carefully before putting itself in this position. Happily, there is no copy-protection on eight-bit versions of the compiler.

There are a number of other snags with dB/Compiler, mainly arising from minor differences in the language supported, but most of them are easily overcome. In general, the compiler accepts all the language features of dBase 2.4, except those that are normally invoked only from the dBase dot prompt, such as Modify and Help, or the interactive forms of Create, Append, Edit, etc. Also, it is not possible to use Debug, Echo, Step, Talk and the like — these are always disabled. Neither can you Peek and Poke or call machine-language subroutines.

The most serious difficulty I have had with the compilable language is the inability to use macros in the names of command files. I like to use a macro containing the drive designation as part of a file name. This simplifies the transfer of programs to machines with different disc arrangements. But this is impossible with dB/Compiler, since it must know at compile time where all command files, etc. reside. Fortunately, this restriction does not apply to databases or memory-variable files.

Given the undoubted boost that dB/Compiler will give to dBase II, Ashton-Tate's aloof attitude towards it is surprising. A spokesman said that the company acknowledges the existence of the compiler but has decided not to recommend it, which is especially strange considering that it is almost impossible to develop any useful applications with the compiler alone. If nothing else, you must buy dBase II to create and modify your database structures.

Improved dBase II

Ashton-Tate's answer to the shock waves caused by dBase III was to declare a policy of continuing enhancement to dBase II. With excellent timing, the people at Culver City released an improved version of dBase II, labelled 2.41, in the same month that dBase III was announced.

At first sight version 2.41 is something of a non-event since most of the enhancements are fixes of very obscure bugs. The only notable new features were the ability to choose different opening and closing delimiters for Get fields, so you could use > and < signs if you prefer these to the simple colon. There is also a very superior Quit command which allows you to exit to a non-dBase function and then return to dBase at the point where you left it, with all memory variables and parameters intact, although databases are not kept open. This facility is available in MS-DOS and PC-DOS versions only.

First-time users

The real selling point of dBase 2.41 is not its programming features, but the assistance it claims to give to the first-time user. This user-friendly front end does not form part of the official release of dBase 2.41, but was added by Ashton-Tate's European offshoot based at Stony Stratford in Buckinghamshire. Both this and the U.S. version are designated 2.41 and are circulating in the U.K. If you obtained your dBase as part of a software bundle with your computer, you probably have the American version.

When you invoke the European 2.41, you are greeted with the message

If you are not a programmer, please type 'Do Menu' and hit Return

The assumption is that you are either familiar with the dBase programming language, or are a newcomer to computing and therefore content to use the pre-written command files called from Menu.Prg. This is silly because most users will fall somewhere between these extremes.

(continued on next page)

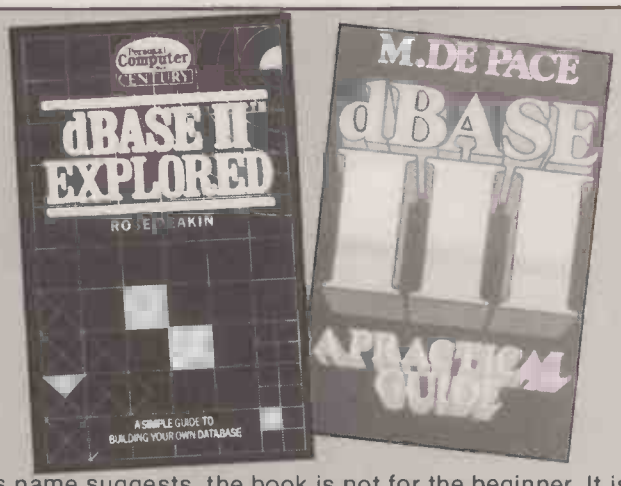
dBase II books

Rose Deakin first introduced me to dBase II, back in 1981. As well as being an accomplished writer, Rose is an enthusiastic dBase user, so when I heard that she was writing an introductory book on the subject I expected something worth reading. I was not disappointed. Her *dBase II Explored* is one the best of the many books on dBase to appear over the last year or so. It is well organised and easy to read. It is one of the few books of its type to emphasise properly the need to plan the application in detail before you get your fingers on the keyboard.

Working with dBase by Mario de Pace is another well-written beginners' text. This and *dBase II Explored* are the only British books on dBase that I have seen, which is a strong point in their favour, as it is refreshing not to have to put up with American terminology and examples.

Of the remaining books about dBase, most provide little more than the material you get for free in the dBase manual. *Understanding dBase II* by Alan Simpson is slightly more adventurous, with some useful sections on interfacing dBase with other software and on producing business graphs from within dBase.

On the other hand, Adam Green's *Advanced dBase II User's Guide* goes far beyond the manuals. It is packed with sample programs, tricks of the trade and esoteric information about the inner workings of the product. As its name suggests, the book is not for the beginner. It is certainly a big improvement on Mr Green's earlier *dBase II User's Guide*, which was one of the most sloppily written computer books I have ever seen.



Of all the books on this subject, the first is still the best: *Everyman's Database Primer* by Robert Byers. This is not a book on dBase, but rather an introduction to the whole subject of manipulating data within a computer. However, dBase II is used for all the concrete examples, and the book is so well written that it can probably teach a novice more about dBase than the official manual can.

(continued from previous page)

In fact, the Menu system is nothing more than a simple set of command files which carry out common flat-file functions, such as creating and updating a database, printing a report and the like. It is a very useful, if limited tool, and a newcomer to dBase might learn a little about the language by studying the source programs. But apart from this it is difficult to see how it will help the user once he or she needs to go beyond these basic tasks.

A better feature of the European 2.41, also aimed at the novice, is an on-screen tutorial called Welcome. You tell the system what you want to do by selecting an option from a menu, then follow the instructions displayed. You see a dBase command being built up on the screen as you proceed. Finally, the command is executed. It provides an effective, if somewhat tedious, way of learning about dBase, especially for people who hate reading manuals.

dBase II Teach Program

Welcome compares favourably to a similar learning aid called The dBase Teach Program, which comes from the Reston Computer Group. The dBase II Teach Program takes you through the elements of database design, entering and updating data, and producing reports. The information is presented on a series of screens, which you have to plod through in the preordained sequence. Occasionally the program gives you the option of going over the last chunk of material again, but most of the time the computer sets the pace, not the user.

However, the program does a creditable job of simulating an actual dBase session, getting you to type commands at a dot prompt and then displaying the results in true dBase style. But it would be a lot more useful if it went a little further and tried to diagnose your errors, or at least made you try to work out for yourself what to enter. No doubt many people will find it a good way of learning about dBase, but they would probably find Ashton-Tate's Welcome program better still.

Copies of dBase 2.41 originating in the U.S. have neither Welcome nor Menu, but they do have a useful program generator called dGen. Like most programs of its type it can only produce fairly basic single-file applications, but I was very impressed with its ease of use and with the quality of the generated command files. I managed to produce a fairly sophisticated mailing system in 90 minutes without a single glance at the manual. I recommend dGen, which is free with dBase, in preference to Fox & Geller's £200 Quickcode generator.

I also recommend the external sort program, dSort, which is included in both the U.S. and European versions of 2.41. This program is run from the operating system prompt rather than from within dBase and is supposed to sequence a database a good deal faster than dBase's internal Sort or Index commands. My own timings confirm this — see box. Also, like Index, dSort allows you to sort on concatenated fields, while the internal Sort limits you to one field at a time.

One final plus point for 2.41 is the hope that it holds out for the eventual implementation of record locking within dBase II. Long ago, Ashton-Tate stated that it would one day provide this feature, opening up the possibilities of multi-user and multi-tasking applications. Version 2.41 does have Lock and Lockndx functions and an Unlock command. They do not actually do anything, but they are at least accepted by dBase II without syntax errors being reported. So an application developer can insert the necessary hooks for record locking into existing systems for use when these functions eventually become available.

The technical people at Stony Stratford say that they are pushing ahead with multi-user versions of dBase II. The first will be for IBM's Ethernet implementation, with versions for Concurrent CP/M and Turbodos also in the works. However, their colleagues in the marketing department are more cagey, saying that no firm decision has been taken about releasing any of these products.

Meanwhile, third-party add-on programs and dBase II enhancements are still being released at a brisk pace. Since we last reviewed this sector of the market — "Enhancing dBase II", *Practical Computing*, December 1983 — many new products have become available, some genuinely useful, others just gimmicky. Ashton-Tate now circulates details of these independent offerings and of the many off-the-shelf packages written in dBase II.

One third-party add-on which stands out from the crowd is Salamanca Software's Expressbase II, an improved version of which has just been issued. It is something between a program generator and a macro pre-processor, with a few of the features of a good text editor thrown in. Its main aim is to reduce the amount of coding and typing needed to develop a dBase application, but there is a lot more to it than that.

At its simplest, Expressbase lets you abbreviate common dBase syntax to two-character strings: AF for Append From, SS for Select Secondary, and so on. Some of them generate entire statements. for example, N6 gives

```
@ 23,0 Say "Please Wait — Printing in
  Progress"
```

Other abbreviations operate on lists of fields specified by the programmer.

The real strength of Expressbase is its use of a library of pre-coded dBase routines, which you can add to and modify yourself. The program line

```
&. DD/MM/YY,Invdate,84,90
```

will pull in a routine that validates the specified variable, Invdate, for proper DD/MM/YY format, checks that it is in the range 1/1/84 to 31/12/90, and produces all the necessary operator messages.

There is also a feature for painting screens, which looks like dBase's Text/Endtext but lets you include Say and Get fields. You can copy chunks of code from one dBase command file to another, altering selected strings on the way. Also there is a global Search and Replace function which operates on a user-supplied list of files. Other features include insertion and removal of indentations, and stripping comments and blank lines from command files.

The program's author, Piers Mahoney, claims a saving of keystrokes of over 50 percent using Expressbase. In favourable cases, I would think that even better savings are possible. Expressbase is a thoroughly useful development tool that should appeal to every serious dBase programmer.

Suppliers and prices

dBase II version 2.41; distributed by Ashton-Tate, Cofferidge Close, Stony Stratford, Buckinghamshire; available for CP/M-80, CP/M-86, PC-DOS, MS-DOS; £365.

Upgrade from dBase II versions 2.4 to 2.41; distributed by Ashton-Tate; availability as dBase II; £50.

dB/Compiler; distributed by P&P Micros, Todd Hall Road, Rossendale, Lancashire and Micro Minder Consultants Ltd, 36 Replingham Road, London SW18; available for CP/M-80, PC-DOS and MS-DOS; £675.

Expressbase II; distributed by Software Ltd, 251 Goswell Road, London EC1; available for CP/M-80, CP/M-86, PC-DOS and MS-DOS; £125.

The dBase II Teach Program; distributed by Prentice-Hall, 66 Wood Lane End, Hemel Hempstead, Hertfordshire; available for IBM PC and compatibles only; £66.87.

Conclusions

● Ashton-Tate seems determined to carry on supporting and enhancing dBase II. The immediate upgrade to version 2.41 was its first move in this direction.

● New features in dBase II are concentrated on helping the first-time user come to grips with the program.

● Wordtech's dB/Compiler will give a boost to off-the-shelf applications written in dBase II. It provides faster running times, protection of source code and lower distribution costs. But the fact that it is copy-protected in its 16-bit versions will hamper its acceptance by software houses and large users.

● The market continues to be assaulted by dBase add-ons from independent suppliers. One of the best is Expressbase II, which can do wonders for a dBase programmer's productivity. PC

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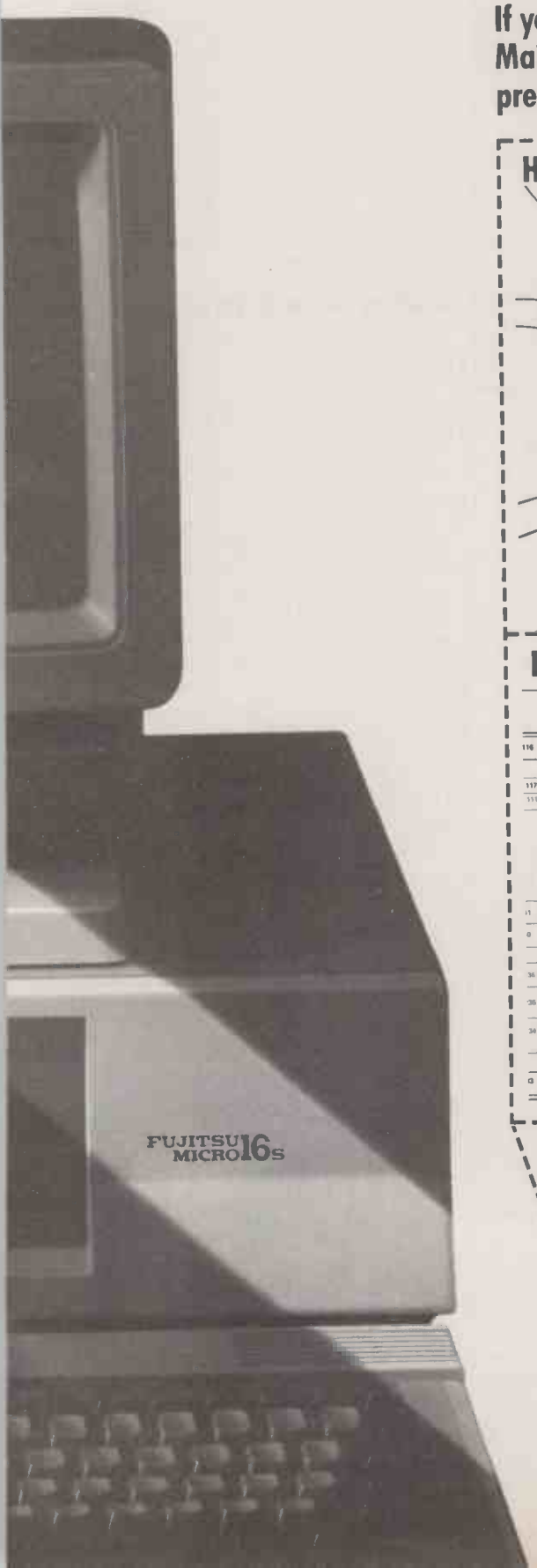

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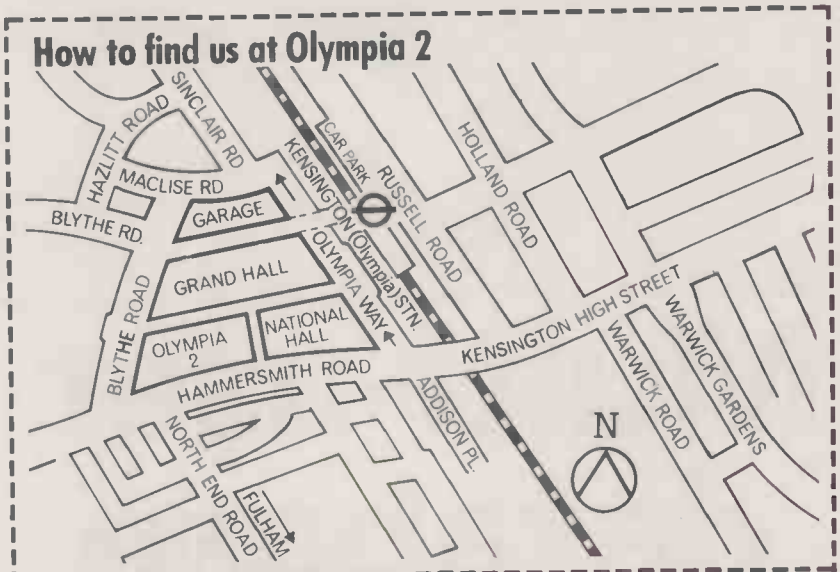

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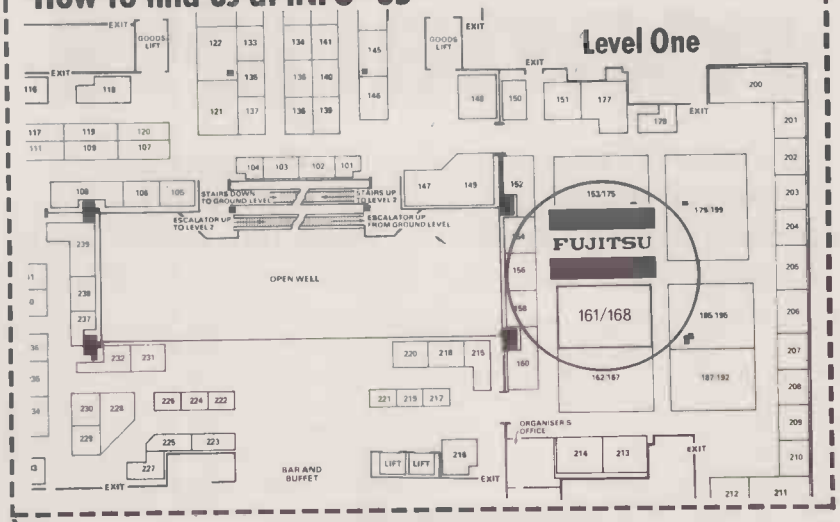

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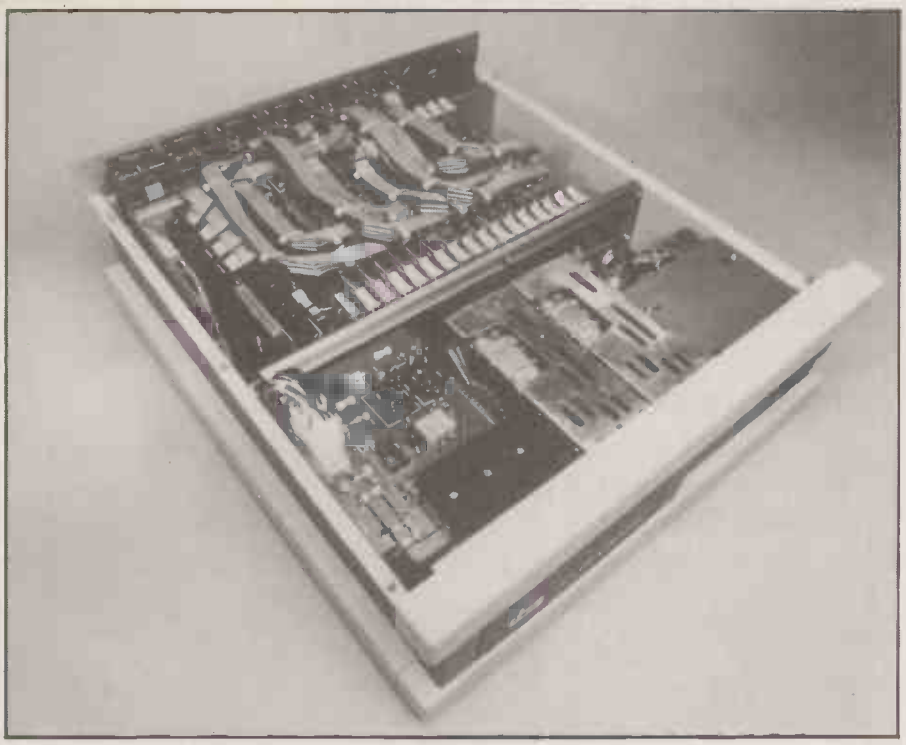

A good way to build a multi-user system is to use an S-100 bus design and provide each user with their own processor card. Here an IBS Ultraframe is shown equipped with 16 such cards, which means that each user does not degrade the system's performance for the others. A similar system is used in other 16-bit British micros such as the HMS Minstrel and Bromcom Superstar.

Multi-user database managers

As databases get larger, and the programs to manage them more sophisticated, multi-user operation becomes almost essential. Peter Laurie examines the problems of putting it into effect.

FOR A WHILE one wondered why God, in his infinite wisdom, had sent us the 16-bit micro. It didn't do word processing or spreadsheet calculations any better than the eight-bit machines. In fact, it often did them more slowly. It had been developed more hastily than the eight-bit machines, by less expert people under more savage commercial pressures. All this showed. It started life as a flawed beast.

However, the divine plan is now beginning to emerge. The obvious use for a big-disc, multi-user 16-bit micro is to hold large amounts of information which are shared around between a small group of, say, six to 12 co-workers. The 16-bit micro is to become multi-user, get socking great discs tacked on and run huge database management packages. As publishers of one of the very few multi-user database-management packages around, my colleagues and I at Southdata naturally approve of this celestial scheme.

All the serious computer shows in the past six months have been infested with multi-user hardware. Multi-user software has been less in evidence. It is interesting to ask why this should be so.

Multi-user operation manifests itself at a number of levels and in a number of forms. It is important to get clear in one's mind the different ways in which it is achieved in hardware before you can talk sensibly about the software. There are three main ways of doing the trick.

The first is multi-tasking, in which a computer is switched between users in such a way that each user thinks that he or she has a computer of his or her own. There obviously has to be a powerful processor and a proper multi-tasking operating system.

As far as the operating system goes, the candidates in common use are Xenix, Unix, Idris — Whitesmith's proprietary Unix — and Multi-User Concurrent CP/M. The operating system has to do a number of tricky jobs. This and the hardware requirements almost guarantee that if it is to work at all a multi-tasking system has to be well designed, but it also tends to make it expensive and over-specified for the user who wants to start small and build up to bigger things.

Users share programs

Under a good multi-tasking operating system, it is also possible to make several users share the same programs. The data areas of each user's programs are kept separately, but they share the same machine-code instructions. This gives some economy in memory at a cost in development time and complexity.

The second possibility for implementing multi-user operation has been seen more in eight-bit machines than 16-bit ones. In it each user is given their own processor, which is linked to the central file server by some fast cable. If the processors are physically in the same box they can share a data bus; if they are physically separate they communicate with the file server by more or less sophisticated and expensive wire.

In many ways this was a good solution. The processors were cheap and as more users were added they did not degrade each other's processing power. Moreover, it was usually quite easy to grow the system as the number of users increased.

The idea seemed to go out of fashion along with eight-bit micros, though suitable 16-bit machines are now becoming available.

In the final method, using a local area network, each user has a stand-alone micro; they may, in the most horrific case, be by different manufacturers. All the machines are connected physically by a network, and logically by more or less sophisticated software. In the simplest case, the dependent machines can read the discs of one other, designated the file server. In more sophisticated examples they can send messages to each other, read each other's discs and, in extreme cases, use each other's RAM. I do not wish to seem cynical, but few examples of this sort of thing working in practice come to one's attention.

Although the different schemes present very different problems to the machine builder and the system software programmer, they all work surprisingly alike at the level of the database manager. The main thing to remember about a multi-user database is that all the data, both in and out, flows through the disc's read-write heads. Processing is relatively unimportant: however powerful and sophisticated the micros, disc access is the limiting constraint.

Some problems

From the point of view of database management there are a couple of problems which arise in multi-user computer systems. The first is known as record contention. When user A alters a record, it must be locked by the database manager so that user B cannot alter it at the same time. This sounds quite easy to do but in practice most database managers are written so that the fields of each record generate parallel files in some sort of way, which are buffered up to reassemble the record.

No doubt this architecture had its origins in the early tape-storage devices, when each field had a tape or a track to itself. Although the hardware has changed, the philosophy has stayed the same. The buffers cannot accurately reflect the current state of the disc, so to lock a record you effectively have to lock all the fields. In a database with several hundred fields per record this means writing to several hundred files — or several hundred places in a single database file — to do the lock. This is not very practical and seems to be why there are so few multi-user database managers.

Blissful ignorance

Happily for us, when we started to write our multi-user database we knew nothing about database design and did not use the traditional architecture. A record to us is a text string with markers separating the fields. It is easy to lock such a record by altering one bit in a header byte. The clever stuff that makes the database do its thing all happens in the indexes, which are separate.

A problem specific to local area networks is that of disc buffering. Networked machines usually run single-user operating systems such as CP/M-86 or MS-DOS, with a bit of code tacked on to handle communications on the network. The single-user operating systems seem to speed up disc access by copying a chunk of disc into a buffer every time it is read.

The argument is that the user will probably want to access a neighbouring portion of the disc next time, and will be agreeably surprised to find that it is already in RAM. Conversely, when the user's program writes to the disc it actually writes to a buffer in memory and from time to time that buffer is flushed on to the disc — thus, again, producing an apparent increase in disc speed.

This is no good at all when the machines are accessing a multi-user database because each machine keeps an image of the database in its buffers and quite certainly the images will not agree with reality. To make single-user machines work multi-user in a network, the operating system's buffering has to be disabled, which naturally makes the machines work less quickly.

Another problem is that single-user operating systems are not written to cope with the rigours of multi-user life. Programs are much more likely to run amuck, and there are no impermeable barriers between them and the crucial disc-status information held in RAM. This can get corrupted, with horrible results to the communal database next time that machine writes to the file server.

Even Multi-User Concurrent CP/M does not handle this properly: the file-control blocks are exposed within RAM, waiting for a morsel of errant code to wreck them. The next time someone writes to the disc you end up with a smashed database. The answer is to use a properly written multi-user operating system like Unix which raises an impenetrable barrier between applications programs and the operating system.

A more academic problem is the so-called deadly embrace. This arises in a relational database when the user wants to alter a virtual record made up of records type 1 and 2. User A gets a lock on record 1, while user B gets a lock on the type-2 record. They both then try for the other and fail, and so on indefinitely. There are a number of solutions: you might, for instance give priority to the user calling for a lock whose first locked record is nearer the head of the file.

Nothing is free

On the other side of the CRT screen there are more troubles. The salient fact about a big database is that it is big. Making one and living with it imposes its own set of problems. The first is that nothing is free, even the all too evanescent database record. It can hardly cost less than 50p to acquire, type in and verify each record in a real-life database.

People agree to this proposition and then airily talk about 70,000-record databases — for instance, an MP's constituents and how he or she has changed their lives in a way that can be vote-catchingly drawn to their attention at election time. When you point out that such a database can hardly cost less than £25,000 — considerably more than the hardware and software needed to run it — the hopeful customer is dismayed.

And then, unless you are cataloguing the major fixed stars, the data is going to slither about. People move in, move out, are born and die. Customers appear and disappear and change their spots. Even the fixed stars move slowly about the sky. Any big database needs to have its data massaged and polished.

It is sensible to think of having to work on at least 10 percent of the records per year, which can be a full-time job and

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The HMS Minstrel 2 is, in effect, a multi-user network in a box. Each user has their own processor, which can be eight-bit or 16-bit, and all are joined to the hard disc by the S-100 bus.

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another substantial cost. And, of course, if someone is working full-time maintaining the database, it has to be running on a multi-user machine so that users can get some virtue out of the thing at the same time.

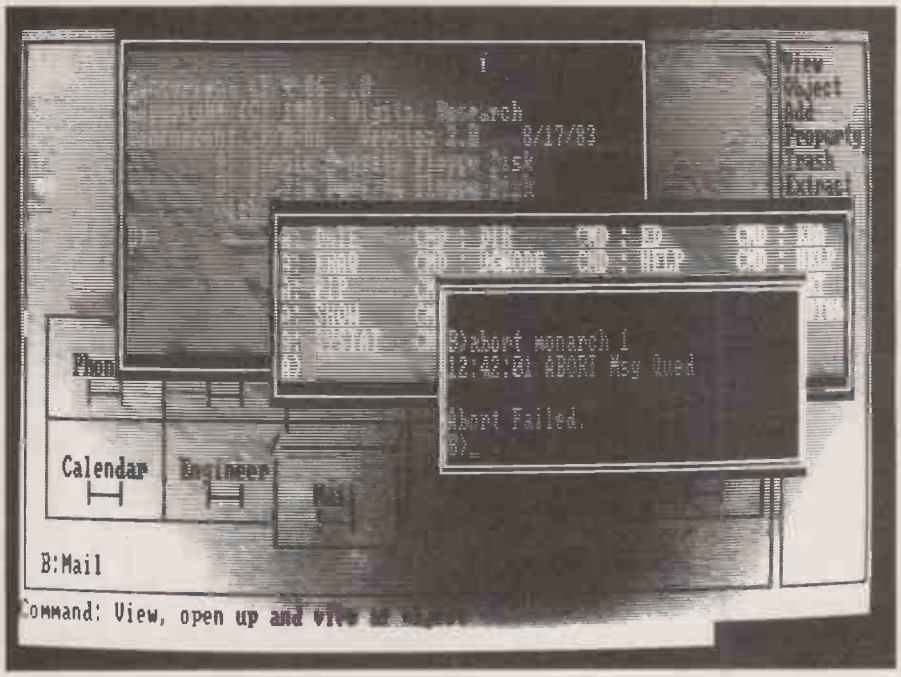
A further problem people stumble over in moving from paper to electronic systems is that computers are far more nervous than paper. An electronic database with the years of work it contains can disappear utterly in the twinkling of an eye. It needs far stricter backup discipline than a paper system, which hardly needs any.

How many times have I had tearful phone calls saying "It seemed to be working so well we didn't bother about the backups. . . ." Data entry, too, needs to be much more tightly controlled. Most of a database is out of sight and it is certainly out of mind. Because no one has to look at entries to perform most functions, mistakes in the data can propagate like weeds and produce hideous blunders.

Act is unclear

A further hassle will soon be introduced by the Data Protection Act. This is a badly drafted statute which seems to assume that characters written on a disc have magical qualities not possessed by the same characters on paper. It is far from clear who is allowed to do what under the Act and what will happen to them if they do or don't do it. This is not the place to try to analyse it, but the effect on many people will be to force them to be seen to be keeping their databases in some sort of security.

This means that the software has to provide password protection, probably down to field level. It will impose all sorts of aggravating restrictions on access to hardware and software. Once the system is up and running, a printout of the databases registered under the Act — which has to be given to anyone who asks — will, I estimate, weigh something like a ton and take several months to read through.



Screen display using Concurrent CP/M with windows. One user can run several programs at once and switch between them at will.

This is not to say that big databases on 16-bit micros are all bad. They just have downsides to their upsides, as do most things in this troubled world. What they do give is instant access to quite large amounts of data, searching if necessary on hints, clues and whispers. They provide small groups of people with almost instant communication. The costs of storage are dropping, but are still way above paper archives, so designers of big micro databases have to make a sensible trade-off between completeness and paring the data down to what is actually worth keeping on-line.

If and when the new laser discs come into general use our philosophy about database management will have to change again. The problem is that to be useful data in a database has to be indexed. This imposes a lot of disc writing, which will take a long time on laser discs. To make the thing useful, a vast database which is slow to access — and mercifully hard to destroy — will live on the laser disc. A smaller auxiliary database will live on big hard discs to facilitate access and to provide a temporary store for new and altered records.

AI and databases

In the more immediate future it seems that people want database managers to broaden out to accept text data as well as the conventional short database fields, and also to accept pictures as special database fields. Developments are happening in other directions too. Southdata has already released an artificial-intelligence package the function of which is to run about a Superfile database and try to discover rules hidden in it. The first serious applications seem to be to investigate creditworthiness criteria among the payment records of customers of banks and big public utilities.

Whatever happens, it seems sure that the stimuli of powerful 16-bit hardware and a rapidly increasing market for data-handling software will give the art of database management a great deal of encouragement and evolve many hitherto unsuspected software products. PC

Peter Laurie is managing director of Southdata Ltd, publisher of the Superfile multi-user database.

Multi-user systems suppliers

	CPU	Major OS	Comments	Phone
Alpha Micro 1000	68000	Amos	Up to seven users	(0753) 821922
Altos 8600	8086	Unix		(0990) 23377
Armstrong Multi-Micro	68000	Unix	Also for science/education etc	(0384) 233433
Bleasdale 68000	68000	Unix		01-828 6661
Bromcom Superstar	80186	IMPOS	Multi-processor system	01-697 8933
Cifer 9000	68000	Unix and CP/M Plus	Four to eight users	(0225) 706361
Country C-4000	80186	Concurrent CP/M	Up to four users	(0527) 29826
Crystal 68000	68000	Unix, Pick	Up to 12 users	021-359 4861
Equinox 8000-S	80186/Z-80	Turbodos	Multi-processor system	01-729 4460
HMS MInstrel	various	Turbodos	Multi-processor system	01-209 0911
IBS Magnum	80186	Turobdos	Multi-processor system	01-222 4701
IMP-68	68000	Unix or Idris	Also six optional Z-80 slaves	(0207) 503481
Jarogate MP-5	80286	Concurrent CP/M	Up to 16 users	01-671 6321
Newtons Accron	68000	Concurrent CP/M	Multi-processor system	01-874 6511
Positron 9000	6809	OS-9		(09252) 29741
Rair BC II	8086/Z-80	Concurrent CP/M	Up to four users	01-836 6921
Systime S-300	8086	MPS, BOS	Up to five users	(0532) 702277
TDI Pinnacle	68000	p-system	Up to seven users	(0272) 742796
Torch Unicorn	68000/Z-80B	Unix, p-system	Can network BBC Micros	(0223) 841000

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- IBM PC compatible colour graphics option
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- 3 parallel ports, centronics compatible
- Intelligent 8 port RS232 expansion option
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Micros are conspicuous by their absence on the main commodities floor.

Progress by stealth

Glyn Moody visited a City broker, where he discovered the use of micros slowly spreading after a cautious start doing routine accounts.

NEW YORK based Drexel Burnham Lambert is America's 10th-largest brokerage company, with equity capital of over $320 million. The firm has a London arm as a base for European operations. As well as handling securities and commodities trading on local exchanges, the London office is responsible for expense control and reporting.

The commodities section in London employs about 250 people, most of whom work on the desks that handle different groups of commodities. For example, the tropicals desk deals with transactions in cocoa and coffee, the grains desk in potatoes and soya beans, and the energy desk in oil and gas.

In an environment that places such a high premium on communications and availability of information, computers have had surprisingly little impact. A mainframe in New York is used to process transaction trading and there are a number of dumb terminals displaying on-line services from information providers such as Reuters. Otherwise, micros are conspicuous by their absence.

However, one small corner of the large and bustling fifth-floor office is gradually being colonised. A year ago the accounts department depended on a lone 256K IBM PC with monochrome screen. Now it has progressed to an additional three 640K machines with full-colour graphics, and a hard-disc unit with tape streamer backup. An IBM PC/AT is on order.

1983 changeover

The road to computerisation began back in 1983, when there was a move towards profit-centre accounting. Costs were to be allocated to each of the 14 individual commodities desks. The man who bore the brunt of the changeover was Jim Reardon, the systems accountant. As he says, "We started off manually, but it just became too much."

First, there was an Apple III, which arrived in a typically ad hoc fashiion. "It was purchased originally for some of the management secretaries to use for word processing. They couldn't or wouldn't use it. So it got swabbed off on to the accounting department. They said 'here's a computer, see if you would like to use it'."

After this inauspicious start, Reardon began investigating what could be done on the Apple using VisiCalc. "I started playing with it, learning what we could do. Until all of a sudden we started doing more than VisiCalc was capable of." An accounting package was needed that would meet the company's special needs.

When nothing was found for the Apple III, the company started looking further afield. Again, the acquisition pattern was slightly arbitrary. The financial controller, Chris Lang, read about the Sunaccounts package in a magazine, and according to Reardon "just followed it up from there." Similarly, the IBM was chosen because it seemed to be the machine to use with the package. Although they took no independent consultants' advice, Lang and Reardon were careful to put the system through it paces.

After the system was purchased, the supplier, Merchant Systems, gave a morning training session on the accounts package and how to use the demonstration ledger. This proved sufficient to get Reardon into the system. "It was just a matter of sitting down and using the demo ledger. I worked through that and then took it from there."

In implementing the changeover from a manual system to a computerised one Reardon was helped by previous experiences. "We were pretty careful when we

The accounts department uses the IBM PCs for spreadsheet calculations.

implemented it, probably because two or three years ago I was involved with the implementation of a new accounting system. I'd learnt a little about the pitfalls and the need to take it slowly."

In particular, Reardon emphasises the importance of parallel runs using a full month's data. "Given the experience of what can happen without lengthy parallel runs, I wanted to give ourselves a good chance by having a good parallel run. I knew that we had to test it completely on the month-end reports rather than taking some invoices and running them through and seeing if the system worked with them." The system was set up in January last year, with parallel runs in January and February. It went live in March.

No shock horror

Compared to some of the horror stories that such changeovers generate, things went very smoothly. Once the system was being used full-time, one or two shortcomings emerged that had passed unnoticed at the time of evaluation. "There were a couple of things we thought it would do at the time of buying it, which it still is unable to do," says Reardon. For instance, it turned out that there were more cost centres than the system could handle. A possible solution was to have some new code patched in by the author of the package, Systems Union. But as Reardon says. "We approached Systems Union about writing that in and they gave us a figure of £1,500. So we said forget it."

One thing the company is having written is a batch-file facility, similar to the batch option available under MS-DOS "so that you can run a whole lot of reports one after another. At the moment Sunaccounts lets you run one report, then you go back to the main menu."

In fact this proved to be the main problem with the new sysem. "One of the big shocks for us once we got the system up and running with data was how long it took to run some of these reports. We've adjusted to it now, but we didn't realise just how long it was going to take our month-end reports. They're usually about four to five hours each in running. It's basically an overnight job, that's why we needed the batch files."

In general, the response time of the system varied according to the particular use. "Posting journals isn't too bad, but with enquiries into accounts that have a lot of data in them, like the telephone account for instance, there's a two- to three-minute delay in getting the information up on to the screen. It's a bit slow."

Speed is quite a common problem with new systems but at least is predictable in terms of its effects. Another difficulty encountered by Reardon was more capricious. "I'm not sure whether it's the machine or the building or a combination of the two, but they seem very susceptible to static. We had a lot of systems failures due to static. We've got static mats down, but it doesn't seem to help a lot."

This is something they have learnt to live with. It has at least had the advantage of encouraging full and frequent backups to be made. Larger maintenance problems are covered by a maintenance contract with Merchant Systems, which Reardon considers indispensible.

Once the Sunaccounts system was working smoothly, people's thoughts turned to other applications. "We read a little about Lotus 1-2-3 and figured that for the price it was probably worth it. We were doing a lot of spreadsheet work on the Apple III with VisiCalc."

The additional facilities of 1-2-3 have proved of real worth. "We use the graph function, we use the data sorting. We're using Lotus just about as much as it can be used. In fact we've got Symphony now." The extra features of Symphony have also been useful. "Symphony is more user-symphathetic," says Reardon. The graphics facilities of both packages are used to enhance management reports.

Partly as a result of the activity in the accounts department, it was decided to begin computerising the personnel section. Reardon had been using Silicon Office for another project but it proved too slow. "But for the personnel function we found it ideal. It's working really well." It took Reardon about a month to set the system up. He found it quite straightforward even though his programming skills were still quite slender: "Silicon Office is a kind of idiots' Basic."

According to Reardon, it is still too early to judge the cost-effectiveness of the personnel system. However, he says "Probably the personnel department would have needed to take on an extra employee this year, whereas now they won't. So probably it will have paid for itself inside the first year."

Definite success

As far as the main system is concerned, Reardon is more definite. "We just couldn't have handled manually the amount of work we're handling now. We've basically got the same staff that we had when we were producing entity accounts and nothing else, which involved maybe 10 foolscap pages a month going to New York. We now produce something like 100 pages of management reports every month. The figures that we're producing now are actually quite meaningful. The figures that we were producing two years ago were accurate, but as a management aid were not really a lot of use."

With such a marked improvement on the past, what does the future hold? Once the IBM PC/AT on order arrives, Reardon thinks that the company will be "looking at networking very seriously. We're waiting to see what PC-DOS 3.1 provides in terms of networking."

Beyond that, there is a longer-term plan for the London accounts department to take over the expense reporting for all the international commodities offices, effectively bypassing the New York branch. The final expense accounts would be sent direct to the mainframe using the PCs as terminals. "New York are obviously trying to hold on to as much as they can, but basically we in London have proved we're completely capable of handling the cost-accounting side of the operation." PC

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PC

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Battery portables grow up

Computing power you can carry around — our top 10 selection, introduced by Ian Stobie.

BATTERY-POWERED portable computers are finding a new and more ambitious range of applications as they become more powerful. The earlier generation of portable machines were used mostly to collect data, doing relatively little with it before passing it on to a larger system or to the human user. All the machines surveyed here can do much more, often equalling the office-bound desk-top machines in their ability to process data themselves.

But portable machines are suited to more than just giving greater geographical freedom to familiar tasks like word processing and spreadsheet analysis. Using software developed by the GLC, home-help supervisors in London are now taking Husky portables along with them on visits to elderly housebound people; they are using the system to check if the client is receiving the correct level of welfare benefit.

The army has been experimenting with the same machine to work out the optimum siting of radio trucks in the field, working out the signal-strength loss from a map of the terrain contained in the machine. Wycliffe Bible Translators has been taking Sharp PC-5000 into remote parts of the world to analyse and document little-known local languages.

What all these applications have in common is the need to store large amounts of data in the portable machine, as well as a program to help the machine's operator make proper use of it. These are so-called knowledge-based or expert systems: the portable has a great advantage because it can be taken to where the knowledge or expertise is required.

To be genuinely portable a computer has to be battery-powered, and for this survey we mean genuinely battery-powered — any machine that cannot survive a typical seven-hour working day without a recharge is excluded.

All the machines here have proper full-size keyboards suitable for touch-typing, except the two machines designed for ultra-rough treatment. Since the Fieldwork Fifty and the Husky Hunter are both powerful systems capable of running CP/M programs like dBase II it is absurd to lump them in with slow, calculator-like pocket computers. The Husky and Fieldwork Fifty sacrifice the standard keyboard design in order to enhance their ability to go almost anywhere.

Suppliers

DG One: Data General, Hounslow House, 724-734 London Road, Hounslow, Middlesex TW3 1PD. Telephone: 01-572 7455

Epson PX-8: Epson U.K. Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 5UH. Telephone: 01-902 8892

IBS Fieldwork Fifty: Immediate Business Systems plc, 3 Clarendon Drive, Wymbush, Milton Keynes MK8 8DA. Telephone: (0908) 568192

HP-110: Hewlett-Packard Ltd, PC Group, King Street Lane, Winnersh, Wokingham, Berkshire RG11 5AR. Telephone: (0734) 784774

Husky Hunter: Husky Computers Ltd, PO Box 135, 345 Foleshill Road, Coventry CV6 5RW. Telephone: (0203) 668181

Olivetti M-10: British Olivetti Ltd, PO Box 89, 86-88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666

NEC PC-8201a: NEC Business Systems (Europe) Ltd, 35 Oval Road, London NW1 7EA. Telephone: 01-267 7000

Sharp PC-5000: Sharp Electronics (U.K.) Ltd, Sharp House, Thorp Road, Manchester M10 9BE. Telephone: 061-205 2333

Tandy models 100 & 200: Tandy Corporation, Tameway Tower, Bridge Street, Walsall, West Midlands WS1 1LA. Telephone: (0922) 648181

TI Prolite: Texas Instruments, Manton Lane, Bedford MK41 7PA. Telephone: (0234) 67466

Small, inexpensive calculator-like machines are produced by firms like Casio and Sharp, and now have good Basic interpreters and reasonable amounts of RAM. But these machines are clearly aimed at a different section of the portables market to the full-blown computers we restrict ourselves to here.

Obviously you pay a price for the ability to move independently of the power supply — portable computers are often slower or have less available storage than a mains-driven machine. But this price is declining very rapidly as portable technology improves. In this survey we have two portable 16-bit IBM compatibles — the DG One and the TI Prolite — and three portable eight-bit CP/M machines which are in many respects as good as anything you may find on an office desk.

The major improvement since our portables survey last year has been in storage. The most powerful machines now have 3.5in. Sony disc drives, and most of the others have substantial amounts of battery-backed RAM, which is no longer prohibitively expensive. Bubble memory is still favoured by a few manufacturers, chiefly those whose machines are intended for rugged outdoor use.

The one remaining area of real limitations is the display. Portable machines obviously cannot use the heavy and power-hungry cathode-ray tube, and none of the alternatives are as good. But things are changing and LCD panels are becoming larger and easier to read.

The modern battery portable has already acquired the ability to run much more than the small calculating programs, data-capture programs and limited text editing which were typical to pioneering machines like the Sharp PC-1500 and the Epson HX-20. Word processing with a full-scale word processor like WordStar, spreadsheet analysis with Multiplan, database management and report generating with dBase II are more characteristic applications for the latest machines.

Since these machines are portable, and mostly have adequate storage, they are also ideal for knowledge-based systems in the widest sense. This is the area where portables are likely to prove pre-eminent in the future. Jack Schofield takes a look at the more traditional area of word processing on portables on page 110 of this issue. PC

DG ONE £2,490

Extremely powerful battery-powered portable computer offering genuine IBM PC compatibility, but at a price. Weighing 9.5lb., Data General's One has a very large LCD panel measuring 10in. diagonally, which can show 80 by 25 lines of text or 640- by 256-dot graphics. The QWERTY keyboard layout feels slightly cramped but Data General claims it to be full size. Inside the One has a CMOS 80C88 processor, 128K of RAM expandable to 512K, and 64K of ROM containing text editor and comms software. A Sony 3.5in. 720K drive is built into the side of the machine, with a second optionally available. MS-DOS is included in the price. Lotus 1-2-3, WordStar and dBase II are available on disc.

For. IBM compatibility. Large memory. Built-in disc.

Against. High price. Poor display contrast on earlier examples.

EPSON PX-8 £798

Powerful A4-sized portable, with CP/M and WordStar included in the price. Weighing just under 4lb., the PX-8 has a fold-away LCD which shows eight lines of text across a full 80 columns or 64- by 480-dot graphics. Inside is a CMOS Z-80 look-alike processor running at 2.5MHz, and 64K of RAM. CP/M 2.2 comes built-in, together with WordStar, Microsoft Basic, Cardbox Plus and Micropro's Calc program on plug-in ROMs. A built-in microcassette drive offers 32K per side storage. A £200 clip-on expansion unit adds 128K of RAM, treated by CP/M as a silicon disc. Other options include a battery-powered 3.5in. microfloppy disc, printer and acoustic coupler. A similar machine with a 40-column display is available from several OEMs.

For. CP/M and WordStar. Big display. Optional silicon disc.

Against. Display is hard to read in poor light.

FIELDWORK FIFTY £1,760

Tough, light portable that runs CP/M software and uses bubble memory instead of discs. Intended for use in harsh environments, it is waterproof and floats. Weighing 3lb., the machine has a two-line by 40-character LCD with backlight for night-time use. The keyboard is slightly less than full size, and available in various layouts. The processor is a CMOS variant of the eight-bit Z-80, and the machine comes with 56K of RAM. The standard 64K of bubble memory is expandable to 256K. It comes with Microsoft Basic and a CP/M-compatible operating system, which makes it possible to run CP/M 2.2 programs such as dBase II. A full RS-232C is fitted, and several micro to mainframe comms packages are available, as well as a bar-code reader.

For. Very tough. Runs CP/M software.

Against. High price. Small display.

HP PORTABLE PC £2,995

Powerful battery-powered portable with very good bundled software. The Portable PC has already gone under several different names in its short career: HP-110, Gypsy and Nomad. It weighs 6.5lb. and has a full-size keyboard. A fold-down LCD shows 16 lines of 80 characters or 126- by 460-dot graphics. Inside is an Intel 8086 processor and 272K of RAM, some of it configured as a silicon disc. The Portable PC comes with a massive 385K of ROM, containing MS-DOS, Lotus 1-2-3, HP's Memomaker word processor and comms software, as well as a similar user-friendly front end to that offered on HP's 150 desk-top machine. Options include a battery-powered 3.5in. Sony disc unit and acoustic coupling modem, which connect to the 110's HP-IL and RS-232 ports.

For. Lotus 1-2-3 in price. Good range of add-ons.

Against. Keyboard not perfect.

HUSKY HUNTER £997

The extremely robust Husky Hunter is still the smallest machine running CP/M software. It has a cast aluminium case measuring 8.5in. by 6in., and weighs 2.5lb. The Hunter is built to stand up to harsh conditions, and the QWERTY-layout keyboard is not full size, but it is sealed and waterproof. The eight-line by 40-character LCD can also show 64- by 240-dot graphics. Standard RAM is 80K, expandable to 352K, some of it configurable as a silicon disc. A CP/M 2.2-compatible OS, Microsoft Basic, text editor and comms software to drive the RS-232 port are supplied in ROM. The Hunter's CMOS processor can run CP/M software as fast as a typical eight-bit desk-top system. Options include modems and a mains-powered disc drive.

For. Fast. Very tough. Large CP/M software base.

Against. Small keyboard.

Battery portables: top 10

NEC PC-8201a £299

The PC-8201a is built by the Japanese firm Kyocera, which makes very similar machines for Olivetti and Tandy. All three versions pack an eight-line by 40-character LCD and a full-size keyboard into an A4-sized package weighing under 4lb., and are built around the same eight-bit CMOS processor, the 80C85. A cassette interface lets you store programs and data on a domestic tape recorder. The NEC version starts with 16K of RAM, expandable to 96K. The optional RAM expansion cards are battery-backed and can be exchanged with their contents intact. The NEC's 32K ROM contains Microsoft-written text-editing program and a full Basic. There is a full RS-232 interface. Used with any suitable modem, the NEC is ideal for Telecom Gold.

For. Price. Good memory expansion. Good Basic. Nice keyboard.

Against. Few dealers.

OLIVETTI M-10 £399

Like the NEC and Tandy portable machines, the M-10 is built by Kyocera around the same eight-bit 80C85 processor but this time the base model comes with 8K of RAM, expandable to 32K. Physically the machine is very similar: A4-size, weighing under 4lb., with good-quality full-size keyboard and eight-line by 40-character LCD. The Olivetti's display pops up for better viewing and probably is the most readable of the three. The 32K ROM contains Microsoft's text editor, Basic, and simple address list and appointments programs. The Basic is good but slightly inferior to the NEC version. Olivetti is giving away a free mailbox on the Telecom Gold electronic mail service, a matching battery-powered acoustic coupler costs £250. Multiplan is available on plug-in ROM for £95.

For. Clear display. Olivetti name. Good support for Telecom Gold and comms.

Against. Less memory expansion potential than NEC. Pricey.

SHARP PC-5000 £1,195

Competitively priced battery-powered portable with MS-DOS and optional bubble memory. The Sharp PC-5000 comes with eight-line by 80-character LCD also capable of showing 80- by 640-dot graphics, and a full-size QWERTY keyboard. Inside is an Intel 8088 processor, 128K of RAM expandable to 256K, and 64K of ROM containing MS-DOS 2 and GWBasic. A plug-in 128K bubble-memory module adds £169 to the price, and is really necessary to do much with the machine. An optional battery-powered A4 printer, price £275, clips on to the PC-5000 to form a single neat portable unit. An external twin floppy-disc unit is available for £675. Some packages, including Supercalc, WordStar and Superwriter, are available on bubble cartridge or ROM.

For. Keen price. MS-DOS. Bubble option. Clip-on portable printer.

Against. LCD panel hard to read. Bubble software expensive.

TANDY 100/200 under £1,000

Tandy look like being first off the mark with the new Kyocera machine, the Tandy 200. This has a 16-line by 40-character LCD, 24K of RAM expandable to 72K and 72K of software in ROM, which includes Multiplan as well as an improved version of the text editor found on the Tandy 100. Like the earlier machine the Tandy 200 is built around the 80C85 chip, so there is no immediate prospect of CP/M compatibility. Tandy hopes to have British Telecom approval for a built-in modem when the 200 goes on sale in the U.K. around June. Tandy continues to sell the cheaper Tandy 100, which has an eight-line display and 8K of RAM expandable to 32K; it costs £303 and is basically the same machine as the NEC and Olivetti portables surveyed here.

For. Tandy 200 has large display, good memory expansion and Multiplan.

Against. Tandy 200 is not yet here, and looks pricey. Tandy 100 has limited memory expansion.

TI PRO-LITE £2,995

Expensive 16-bit IBM-compatible portable similar to Data General's One, but offering even more facilities. The Pro-Lite is heavier at 10.5lb. and has a larger 12in. LCD showing 80 by 25 lines of text or 640- by 200-dot graphics. Inside is the same 16-bit CMOS processor, the 80C88, but there is 256K of RAM expandable to 768K. However, the entry-level Pro-Lite is a mains-powered machine. TI is offering a 5lb. clip-on battery pack which provides eight hours of power for under £200. A 720K 3.5in. drive is built into the side of the machine, with a second optionally available. TI offers a PC interface cable which lets you transfer files from an IBM PC or TI Professional. MS-DOS is included in the price. Volume shipments to the U.K. are scheduled for March.

For. IBM compatibility. Large memory. Built-in disc.

Against. High price. Portable version is quite heavy. New.

Word processing for all reasons

Susan Curran introduces this month's special section and explains which WP package to buy for what purpose.

AS THE WORD-PROCESSING market becomes more crowded, a number of software developers are aiming their WP products at more closely defined groups of users. If you frequently send out large mailings, for instance, you probably need a different range of facilities from a journalist, scientist or translator. If you only want to produce e occasional letter or memo you probably need a simpler and more easily remembered package than a frequent business user doing more complicated tasks.

On the next few pages we take a look at WP packages intended for different uses. On page 112 Ian Stobie writes about word processing on the Macintosh, a machine which seems to inspire software writers to come up with new approaches to the major computing applications. And on page 110 Jack Schofield asks how good is word processing on the machines you can take anywhere — the lightweight battery-powered portables. Elsewhere in this issue Roger Cullis reviews WordStar 2000, the new package from the company responsible for WordStar.

Whatever the special use you plan for your word processor, certain general principles of good ergonomic design apply. If you are a newcomer to word processing then it is these that are going to matter most. You will probably find you are better off with a package designed for easy operation than with a monster which has a manual as thick as the phone book.

Ideally, a word processor should allow you to switch on the machine and turn out a reasonable letter or memo in half an hour at most, even if you have never used the package before. It should also enable you to produce complex work using most of the major features on an occasional basis. And you should be able to grasp every feature that the program offers without taking a year-long training course.

All these qualities depend upon good ergonomic design. Easy word processing has little to do with how much the program offers; it is not synonymous with limited word processing. But the practicalities of programming, and the minds of programmers, do often mean that the programs with a small range of features are easier to work with.

Easy to follow

If you plan to be a genuinely infrequent user, then your prime requirement will be an easy-to-follow program with plenty of prompts and help available. This too is not synonymous with ease of use. To the regular user, ease of use means streamlined, sensible command sequences. And the regular user should be prepared to put more effort into mastering the program initially, while the occasional one is really beginning from scratch each time.

For occasional users, the best approach is still the menu approach. Recently the trend has been towards pop-up menus on the main editing screen, not separate full-screen menus. Mnemonic letters are not always a good idea; in order to use all 26 letters, some programs resort to unlikely mnemonics, and the assignment varies widely from program to program.

You need reasonably full descriptions of the features provided, not idiosyncratic or cryptic ones. If there is only room for brief descriptions they should be amplified in Help screens. There should also be a graceful and self-evident escape route from incorrect choices — especially those which have a drastic effect like Load, Merge, Delete, etc. Alphabetical menus are used on Select and Quill, among others.

A few computers have function keys labelled with word-processing functions — the Torch, the Wang Professional and the Eagle, for example. So long as the program is fully installed to make use of them, this is an easy approach, particularly for anyone who cannot touch-type. Touch-typists often find it difficult to locate function keys and prefer control-key combinations, such as Control-D for Delete instead of a special Delete key over on the side of the keyboard.

Keyboard templates are a necessary evil at best. It is not easy work with a template, particularly if it does not fit securely on to the keyboard. Occasional users waste a lot of time searching the template for the key in question.

Mice are less appropriate to word processors than to some other types of program, because you need to use the keyboard intensively to type text. But they do save having to learn complex sequences of Fast Move and Slow Move cursor commands, and they let you make menu selections quickly and easily. The mouse approach at its smoothest is in Macwrite, which is very easy to use, though not par-

(continued on next page)

Basic WP

	Micro	Supplier
Bank Street Writer	Apple, Atari, CBM 64, IBM	Softsel
Homeword	Apple, Atari, CBM 64, IBM	Softsel
Jane	Apple, IBM	P&P
Quill	QL, IBM, MS-DOS	Psion
Leading Edge	Apple, IBM	P&P
Macwrite	Macintosh	Apple
Multimate	IBM	Softsel, P&P
PFS Write	Apple, IBM	Softsel, P&P
Select	IBM	Mayfair
Vizawrite	CBM 64	Viza
Volkswriter Deluxe	IBM	Softsel
Wordwise	BBC	Computer Concepts

For authors and journalists

	Micro	Supplier
Macauthor	Macintosh	Probe
Macwrite	Macintosh	Apple
Microsoft Word	IBM, Macintosh	Softsel, P&P
Multimate	IBM	Softsel, P&P
Perfect Writer II	IBM, MS-DOS	Thorn EMI
Book Machine	ACT	Prefis
Superwriter	IBM, MS-DOS, CP/M, CP/M-86	Sorcim
Tea	CP/M	Colossum
Word Perfect	IBM, MS-DOS	Softsel, ACT
Wordpro series	CBM-64, all Pets	Wego
WordStar	CP/M, IBM, MS-DOS	Micropro
WordStar 2000	IBM	Micropro
Vizawrite	CBM 64	Viza

Scientific and foreign text

	Micro	Supplier
Arabstar	IBM	Aptec
Displaywrite II	IBM	IBM
Framework	IBM	Ashton-Tate
Lotus 1-2-3	IBM, MS-DOS	Softsel
Macwrite	Macintosh	Apple
Spellbinder	IBM, CP/M, MS-DOS	Sierra, Encotel
Spellbinder/Arabic	IBM	Sierra
Spellbinder/Scientific	IBM, MS-DOS	Sierra, Encotel
Symphony	IBM	Softsel
Superwriter	IBM, MS-DOS, CP/M, CP/M-86	Sorcim
Volkswriter Deluxe	IBM	Softsel
Volkswriter Scientific	IBM	Softsel
Vuman	ACT	Vuman
Wordwise with Languagewise	BBC	Computer Concepts

Output that impresses

	Micro	Supplier
Lisawrite	Lisa, Mac XL	Apple
Macwrite	Macintosh	Apple
Microsoft Word	IBM, MS-DOS, Macintosh	Microsoft
Perfect Writer II	IBM, MS-DOS	Thorn EMI
QXText	Epson QX-10	Epson

Boilerplating and mail-merge

	Micro	Supplier
Alphatext	Alphatronic PC	Triumph-Adler
Displaywrite II	IBM	IBM
Framework	IBM	Ashton-Tate
Microsoft Word	IBM, MS-DOS, Mac	Microsoft
Oliword	Olivetti M-20, M-24	Olivetti
Scripsit	Tandy	Tandy
Spellbinder	IBM	Encotel

Doing it on the cheap

	Micro	Supplier
Amsword	Amstrad	Amsoft
Atariwriter	Atari	Atari
Bank Street Writer	Apple, Atari, CBM 64, IBM	Softsel
Bonny Blue	IBM	Paperlogic
Easyscript	CBM 64	Precision
Homeword	Apple, Atari, CBM 64, IBM	Softsel
Merlin Scribe	BBC	Merlin
Quill	QL, IBM, MS-DOS	Psion
Scripsit	Tandy	Tandy
Tasword II	Spectrum	Tasman
View	BBC	Acornsoft
Vizawrite	CBM 64	Viza
WordStar — if bundled	Sanyo, Osborne, etc	Micropro
Wordwise	BBC	Computer Concepts

(continued from previous page)

ticularly powerful. Microsoft Word is more powerful and correspondingly less easy to learn.

Disc-based training courses tend to be faster to use, more flexible and a more positive introduction to the program than a manual course can be. A manual course is a passable second-best: too many fat manuals do not provide one, and many more lack one that is suitable for users already familiar with other word-processing programs.

Simple disc-based courses are provided as part of the package with, among others, Select, Multimate and Volkswriter Deluxe. They provide a reasonable guide through the basics, and are adaptable in varying degrees according to evaluation of the user's progress and, of course, the user's choice of important features. Some independent companies offer training courses, either disc-orientated or more general hands-on, for other popular word processors.

Most people like the WYSIWYG — what you see is what you get — approach. In fact, there are three main classes of program. First, there are programs where everything is echoed on screen — the justification, the double spacing, the bold print and so on. No control codes are employed. This looks snazzy, but makes life very difficult if you want to do something that is not reproducible on screen. Frequently you find you can't. Microsoft Word and Quill work on these lines.

Secondly, there are programs which reproduce the general layout of the text on-screen without attempting to reproduce special print modes, which are handled by control codes. On many good programs, including the WordStar family, Displaywrite II and Olivetti word processors, it is possible to choose between viewing the codes, or suppressing them to check on the final layout. This is my preferred approach. Some programs use graphics control codes whose meaning is not immediately apparent. A good program will provide an on-screen key to the meaning.

Finally, there are progams where all formatting is handled through control codes, or in a separate print-formatting routine. The screen display bears little relation to what appears on the paper. Though there are plusses in this approach for heavy-editing regular users, there are none for the occasional user. Avoid programs which do this, like Perfect Writer and others of the Emacs school.

It always helps to have a ruler on screen to show where tabs and margins are set. Not all rulers show tabs and margins. Those on WordStar 2000, for example, do not handle different type pitches correctly. Ideally, a new ruler should appear in the text wherever the settings are changed, and the program will remember the settings for each section during subsequent edits.

It is very difficult to achieve true WYSIWYG on a 40-column screen, as used on many home computers; typical text lines contain more than 40 characters. Some programs try to achieve it by scrolling across the text, which does not make life easy when it comes to reviewing what you have written. Among the alternatives are a quick reformat between editing and printing — this works well in Vizawrite on the Commodore 64 — and a separate view screen or section to show how things will look, as used to good effect by Wordwise on the BBC B, for example.

Suppliers

Aptec: 01-328 7272
Acornsoft: Cambridge (0223) 316039
ACT Pulsar: 021-501 2284
Amsoft: Brentwood (0277) 230222
Apple: Hemel Hempstead (0442) 60244
Ashton-Tate: Milton Keynes (0908) 568866
Atari: Slough (0753) 24561
Colossum: 01-435 9321
Computer Concepts: Hemel Hempstead (0442) 63933
Encotel: 01-680 6040
Epson: 01-902 8892
IBM: 01-578 4399
Mayfair Micros: 01-870 3255
Merlin: Swansea (0792) 467980
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Microsoft: Windsor (07535) 59951
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Tasman: Leeds (0532) 438301
Thorn EMI: Farnborough (0252) 543333
Triumph-Adler: 01-250 1717
Viza: Medway (0634) 813780
Vuman: 061-273 5315
Wego: Caterham (0883) 49235

We would like to thank RAK Computers Ltd of Norwich for the loan of machines to test programs for this feature.

For authors and journalists

SURPRISINGLY few word-processing programs are promoted particularly for authors and journalists; perhaps it is that we are a small market compared to professional secretaries and typists. However, we have quite different needs, and some programs meet them far better than others.

Most dedicated word processors are aimed at audio or copy typists who work through page by page, typing in prepared text, and then work through again sequentially to make corrections or revisions. The emphasis is on making this routine task easy.

Writers, by contrast, may want to start with rough notes and work slowly up to finished copy. Many expansions, revisions and changes of order may be made on the way. The program has to be robust enough to cope with massive changes in the text without either crashing or dropping to a snail's pace.

Popular WordStar

Whatever WordStar's other failings, it meets this requirement with ease — hence its continuing popularity. Superwriter does too, and the same applies to Perfect Writer once you have learnt to avoid the bugs. A few programs work in one direction only: for example, it is only possible to work forwards through long disc-based files using Spellbinder.

Many writers find it difficult to work with a page-based system, where it is impossible to see the bottom of one page and the top of the next on-screen at the same time. This is largely true, for example, of Displaywrite II and of several other recent word processors for the IBM PC. Page orientation seems to be in vogue. The plus point which may outweigh the disadvantage is the ability to go to any page without fuss, which is a real boon in a long document.

Journalists may value the offer of a separate scratch pad area on which notes can be stored. Several Commodore 64 word processors do this, including Vizawrite and Wordpro 3 Plus/64. Multiple document handling is available with Perfect Writer and other Emacs programs, Microsoft Word and Macwrite. This offers a chance to compare drafts displayed in different screen windows and is an even greater help.

An interesting approach particularly aimed at writers is the tree-linked file system on TEA, a new program from Colossum Software which runs on the BBC with Acorn Z-80 processor, Research Machines 480Z and a motley collection of other micros. From here you can trace a loosely charted route away from word processing, via thinking-aid programs like Brainwave, into database territory.

Ideally it should be possible to hold your entire article, chapter, book or whatever in a single file. It is surprising how many systems will not handle long files, and many others will do so only reluctantly. For the author trying to wrestle a long chapter into shape, the ability to link short files in a print queue is really no substitute.

A common maximum length on RAM-based programs is less than 10 pages of single-spaced A4 text. The Gemini word processor for the BBC handles only two pages, and Macwrite will not cope with more than 10. It might be supposed that the trend towards larger memories would solve this problem, but it seems only to have led to longer and more loosely written programs. Over 100K of code is now quite commonplace, and memory can become scarce even on a computer with 192K or 256K. The problem is acute on the Sinclair QL, with 128K, nearly all of which is taken up by screen memory and Quill.

Safety first

If you handle long documents it is important to ensure that the program can deal with them safely. The Multimate approach, in which successive pages are safely stored on disc, is an excellent one. WordStar and many other programs that juggle text between memory and disc can leave you in the awkward situation where your edited file simply will not fit back on the disc. It is certainly no joke if that file represents a day's work that you thought was complete.

Equally important is the need for controls that let you zip around the text from page to page. Many programs suggest that you use Search and Replace for this purpose, but for my money it is not an ideal tool. Page-based systems score here, as is recognised in WordStar 2000, for example. If you opt to work with short, linked files, then it is important to ensure that the program can link them effectively, can Search and Replace through all of them, and can number pages on successive files, starting at 1 or at any other number you may require.

Equally valuable is the ability to merge data from different files, and to save parts of a file as separate documents. A few programs, like Tandy's Scripsit, make this impossible. Many are more orientated to a boilerplating paragraph approach and will object to shuffling very large blocks of text.

Double spacing

Authors and journalists need to double-space their manuscripts so it is important to find a program that will handle double-spacing efficiently. Double-spaced text on-screen is not always a help: it looks reassuringly normal, but halves the amount you can read at one go. Many publishers will accept one-and-a-half spacing, which saves a fair bit of paper. Not all programs offer it. On some programs, it is possible to switch the text from single to double spacing with a single command sequence. On others, it is necessary to reformat paragraph by paragraph.

A word-count facility is also important. Several programs are incapable of producing a word count quickly and effectively. Among them are WordStar and Microsoft Word.

Automatic footnote handling may sound tempting but in practice it can be difficult to set up. Not all programs handle footnotes in the ways that publishers like to see them. Such facilities tend to be orientated more towards word-processed reports than to typescript that is later to be set in print. Similarly, I do not find automatic indexing particularly helpful myself, as the typescript page numbering will inevitably differ from the proof page numbering. If you produce academic or scientific text you may find such features more of a help.

These features do come into their own, of course, if your publisher uses the same system for typesetting as you use for writing. One system that encourages this way of working is Prefis's Book Machine, a system aimed at both publishers and authors. The author version is a full-blooded word processor which copes with varied type styles and indexing, and includes a draft comparison feature. Pass it on to a publisher using the system, and your text can go straight on to typesetting equipment. The Book Machine runs on Apricot micos and is generally sold as a complete hardware/software package at around £5,600.

Scientific and foreign text

SCIENTIFIC REPORTS and foreign-language documents have one feature in common: they both make use of non-standard symbols and characters. If you produce this type of material you will need a word-processing system that specifically enables you to produce special symbols. Scientific word processing has some other special features too.

Characters appears in three different places: on your keyboard, on your screen and on the page that emerges from your printer. Ideally, you press a key marked with the character you want in your document, see it appear on screen, and have recognisably the same character appear on the printout. If a character you wish to use does not appear on your keyboard, you may be able to put it there by using a template or buying a foreign-language keyboard. It is often easier and cheaper for you to get used to pressing one key, and seeing a different symbol appear on screen. An alternative is to work with the same keyboard and screen symbol, and to generate the different symbol you want on the printed output only.

Alternative keyboards

International and fairly up-market micros like the IBM PC family offer different international keyboards. If you work all the time in Spanish, say, then the obvious answer is to order a Spanish keyboard; it may be simplest to buy a computer in Spain. You must then ensure that your word-processing program uses this keyboard configuration, and reproduces the right character on-screen, and that the printer driver reproduces it on the printer.

If you work only occasionally in Spanish, French, Norwegian or whatever, then you need a utility that allows you to select different key configurations on request. You press the same old key, but a different symbol appears from the screen onwards. Displaywrite II on IBM PCs is one program that does this. There is a choice of alternative key configurations, including European-style foreign-language characters, Greek letters and common scientific symbols.

A much cheaper system that has the same capabilities is the Wordwise/Languagewise combination for the BBC model B. Languagewise is a separate program from Dataware that works with Computer Concepts' Wordwise. It sets up additional accented and currency characters for 12 families of foreign languages, including Albanian and Turkish; it does not cover Greek, Russian or other non-Roman alphabets. The characters are substituted for less often-used keyboard symbols, and they appear properly in preview mode — but not in the mode 7 that Wordwise uses for editing — and on an FX-80 printer.

```
For this sample, I defined a box within the Easy
Script program, and now use it to print with:
Is the capital of Italy:
    ☐    Florence
    ☐    Rome
    ☐    Naples
Tick the answer you choose.
```

User-defined outline boxes on the Epson FX-80 using Easy Script on a Commodore 64.

```
Paulin      Ne troublez point le cours de votre renommée
            Déjà de vos adieux la nouvelle est semée;
            Rome, qui gémissait, triomphe avec raison;
```

Printing on an FX-80 set to the French character set, using WordStar on a Torch.

```
  Here are the inbuilt Epson FX-80 (and similar printer) subscripts and
superscripts.    These neat half-sized fonts are very handy for printing simple
equations, e.g.

CH2(COOH)2 + Br2 -> CHBr(COOH)2

            superscript
Normal text                 normal text
                                        subscript
In an equation, this is less neat than the Epson version:

     CH (COOH)  + Br  -> CHBr(COOH)
       2      2     2             2
```

There are two ways of producing subscripts and superscripts: by switching to a half-size fount (top); or by feeding the paper up or down a line or half a line (bottom).

A simpler option is to use the same old computer and program, but adapt your printer. You can get new characters on a daisywheel printer simply by slotting in a different daisywheel. New characters on a programmable matrix printer can be constructed by sending control codes or setting DIL switches. So long as the new character is accessed by a code that the keyboard generates, there is no problem.

Sometimes this is not the case, even with the humble £ symbol. Then you must send the ASCII code in a direct form. Some word processors allow you to do this; many, particularly the up-market ones aimed at secretaries, do not. Superwriter — son of Magic Wand by Peachtext — on the IBM and compatibles will do it, for example; WordStar will not.

Most Epson printers and similar matrix machines have eight or nine international characters sets; some include Japanese Kana characters. You can select one either initially using DIL switches, or in mid-print using control codes. On programmable matrix printers you can design your own characters as well, using either keyboard or non-keyboard codes for them. You run a program to set them before using your word processor. Amend the printer initialise routine, if necessary, so that your good work is not undone.

Most reputable word processors handle subscripts and superscripts. If you think you will need them, check that your chosen package will produce them. For complicated equations, it can be useful if you can set up several levels, using sub-subscripts and super-superscripts.

The programs most inclined to include simple maths are those derived from dedicated word processors, like Displaywrite II and the Wang WP program. There is also a touch of the calculator in Wordsworth for the BBC model B. My feeling is that these features are not much use to scientists. The maths is strictly orientated to simple report production: averaging and totalling columns, for instance. In general, there is more to be said for a program that can import calculations from a spreadsheet. Many will do so, though with varying ease, and of course there are word-processing elements in spreadsheet-orientated integrated packages such as 1-2-3, Symphony and Framework.

Output that impresses

WITH SOME word processors, the accent is on giving the user as much freedom as possible to compose and edit a document. With others, it is very firmly on high-quality presentation, and a variety of systems are available which emphasise the appearance of the printed document.

Presentation on-screen is important, particularly for those who handle electronic mail. For most users, though, it is printed presentation which matters. Not all programs which pay detailed attention to print make any attempt to reproduce the print styles and/or the final format on-screen.

Letter-quality print primarily means daisywheels, though there are other types of up-market printer, such as expensive ink-jets and laser printers. Daisywheels provide high quality at the expense of some versatility. They are not suitable for graphics-orientated output.

With a daisywheel, you can only reproduce the characters that are available on the print wheel. Good printers offer a variety of different wheels, and there should be a fair range of scientific symbols, foreign-language characters and so on available on specialist wheels. The most common variation is in fount.

Limited range

Basic print commands vary little, but the control codes for accessing special print features tend to very specific. A word processor that supports special features will do so only for a limited range of named printers. The ranges vary from program to program: among the most popular are the NEC Spinwriter, Qume Sprint, Diablo and Xerox machines. They are all comparatively expensive. Cheap daisywheels do not offer the same type of feature, and you will not be able to extract similar quality output from them.

Most WP/printer combinations can handle simple justification by dint of adding extra spaces between the words, distributed along the line as evenly as possible. A much neater effect is created if the letters can be distributed evenly along the line, using smaller spacing increments. Many printers manage spaces as small as 1/120in., compared to the 1/12in. of an ordinary 12-pitch space. This is known as microspace justification and is offered — on a limited range of printers — on most up-market WP programs.

A more advanced form of microspace justification handles proportional spacing, and will leave less space around an i than around w. This is not a common feature. It is available on some specialist print programs, such as the U.S. Magicprint which links to most MS-DOS word processors.

Most matrix printers offer a few alternative type styles, such as pica, elite and italic. On a programmable matrix printer it is possible to produce other type styles by bit-image programming. Though the result can be quite snazzy, it still has a dot-matrix look to it which does not appeal to many business users.

You can get a lot out of a matrix printer by Basic programming, but comparatively few word processors will do the hard work for you. The task is much simplified on the Epson QX-10, with its 16-fount on-screen and on-printer capability. QXText handles the lot with reasonable aplomb.

```
With daisywheel printers, a switch of daisywheel gives you a new
font.      On   mine,   it's   possible   to   select   the   pitch
independently, so that this passage, although in Prestige elite
which is intended at as 12-pitch typeface, is printed in 10
pitch.

This   paragraph   is   in   Courier,   a   popular   10-pitch   font.
Contrast passages in a slightly different font like this could be
used as a subtle way of enhancing presentation.

Tile Italic font can be used at either 10 or 12 pitch.     I find
it useful as a 'computer-like' font for program listings, as well
as for normal italic contrast.
```

Most printers which support proportional spacing have a pitch setting switch of some kind. This is printed from Wordstar on a Tandy daisywheel using the Madeleine proportional spaced font. Wordstar is set to normal 10-pitch output, but the printer setting overrides this, and proportional print emerges. As it is not possible (at least on my system) to justify proportional spacing, this passage is not justified.

Top: On daisywheel printers you have to physically exchange daisywheels to change founts. More subtle effects can be produced by altering the pitch, or number of characters printed to the inch.

Bottom: Proportional spacing is handled as a printer-controlled feature on many daisywheels, and you need no special word-processing capabilities to produce it. The example shows proportionally-spaced type on a Tandy daisywheel using WordStar set to 10-pitch type.

More popular nowadays is the Apple Macintosh, which produces amazing output on-screen and on the Apple Imagewriter. Among Macwrite capabilities are a variety of fount styles and print sizes, and stylistic variations such as italic, outline and shadow printing. It is also possible to combine Macwrite output with diagrams and illustrations produced by the Macpaint package.

Special requirements

Electronic mail has some special requirements. The ideal output is a simple ASCII text file, unadorned by unlikely control sequences. It should then be possible to read it both on your own word processor and on a quite different word processor that your recipient may be using, or directly from the operating system as a text file. Some word processors will produce output files in two flavours: with control codes for printing, and in ASCII format without control codes for electronic mail or for use in other programs. This is a handy feature, even if you see no immediate need for it.

Reports intended for distribution in typed form will be much improved if your word processor can handle a variety of different headers and footers. A feature missing from some programs is provision for alternate odd/even-page headers and footers. Useful too are alternate odd/even left and right wide margins to simplify binding.

Some programs orientate themselves particularly towards report production, and will handle automatic numbering of paragraphs, automatic footnote placement, and the compilation of contents pages and indexes. Perfect Writer is a prime example. It is powerful, but not very transparent, and only an experienced user will avoid the occasional nasty surprise.

Boilerplating and mail-merge

SOME FIRMS produce form letters on a truly monumental scale. These suggestions are mainly for those doing it more modestly, not for credit-card companies or magazine promoters.

"Boilerplating" is the name given to glueing together a selection of standard paragraphs to produce an individual document. It is quite different from mail-merging, in which you merge a skeleton letter with a file of variable information giving successive names, addresses and other specific information to be incorporated into it. At the top of the scale, the two combine to produce sophisticated capabilities where different form letters can contain different sequences of paragraphs.

Large-scale boilerplating comes into its own in solicitors' offices, where very similar documents are built up repeatedly out of standard paragraph building bricks. On a smaller scale, most word-processor users find that they repeat the same text again and again in different contexts. We all have regular correspondents, for instance, whose names and addresses do not alter from letter to letter.

Repetitive letters

Take, for example, a pretty typical word-processing task: a business letter. The date will be repeated on maybe 20 letters written that day. The correspondent is a regular client to whom a letter is written perhaps once a month. The first couple of paragraphs are unique, but the third — perhaps details of a new product or of new credit terms — needs to be repeated more or less verbatim on all letters to clients over a fixed period. Taking all these elements together, a large proportion of the letter content is repetitive. Producing the letter can be simplified if the date, the address and the standard paragraphs are all held on disc in files that can be accessed with a minimum of keystrokes.

It is possible to combine sections of text on most word processors simply by giving a Merge Files command and then the name of the file in question. But often the number of keystrokes involved and the time taken are disproportionate to the length of a short piece of text, such as an address. A handy way of simplifying the job is by using a special quick-access library of words, phrases or paragraphs.

On some systems, short words or phrases are referenced by simple keystroke combinations such as Control-number or Escape-number combinations. There will be a maximum of maybe 10 or 20, enough to allow you to set up a few short pieces of frequently used text, which may be from a long word to an address in length. They are held in RAM, though ideally they should be stored on disc too, and can be called up instantly. I used this system on Scripsit and have mourned its lack on most other word processors ever since. I have also encountered it on Alphatronic and Olivetti word processors.

The Olivetti system is one of several that uses double-level access. You set up both a short-phrase library and a larger disc-based long-paragraph library with up to 100 entries. This can be used for a fairly small library of standard text paragraphs, for instance, or for a small database of names and addresses.

Space-saver

Some such systems read the stored text into a new document. Others don't bother: the document simply lists cues for printing the sequence of paragraphs. You do not get a preview of the print layout with this method, but it does cut down the size of documents and saves disc space. Displaywrite II works on these lines.

You can handle simple form letters manually on just about any system by setting up a skeleton letter file on disc, reading it into memory, and then typing in the variable information. It helps if the word processor has an Overprint mode, so that the original layout is preserved.

Doing this, you need to type all the names, addresses, etc., or to read them individually from other files. A more efficient arrangement sets up a name-and-address file, from which data is read set by set into the letter skeleton. This is what is generally meant by a form letter or mail-merge capability.

The simplest such systems expect your variable information file to be strictly sequential. Each word or sentence from it is used once, and slotted into the letter skeleton in the order in which it is read from the file. The cheapest workable system that I know of along these lines is Wordsworth for the BBC, which costs around £22.

The system has one strict limitation: data from the variable file can be read into only one place in the skeleton, though it can be of any practicable length. More advanced systems allow you to reproduce the same information from the file at several points in the letter, or to shuffle the order. This capability is available on most business-orientated word processors.

This approach is not much use if you want to vary the list of addressees to whom you will send letters: picking, say, clients with overdue bills, or clients who do more than a certain amount of business, or club members whose subscriptions are due in a particular month. Good systems allow you to set up a single variable list and then to mark sets for inclusion or exclusion in a particular form-letter run. This can be done manually by typing an Ignore symbol before unwanted entries in the file, or by keying Yes/No as the addresses are displayed on screen. Alternatively, it can be done automatically, according to the If-Then criteria you give.

Like a database

The more sorting and selecting you need to perform on your variable list, the more it comes to resemble a database. In fact, the common approach is to leave sorting and selecting to a database program, and to have it compile a variable list which is fed into the word processor. You can do this either with sets of inter-related programs, or with all-in-one programs combining word processor and database, or with some unrelated programs that use a basic ASCII file structure.

Many mailing-list orientated database programs do themselves provide sufficient word-processing capability to allow you to turn out a short form letter. Busipost is a good business-orientated example. Few will handle letters over a page in length, and editing facilities tend to be primitive. Some mailing-list programs actually produce addresses on sticky labels only and it is difficult to compile a sequential file from them. Several BBC programs are prime offenders here.

Mail-merging sounds straightforward enough, but the way in which it is implemented makes it a horrendous task on some systems. Ease of use is an important criterion. If the program does not have the in-built capabilities you want you can sometimes program them in. Programming facilities that could produce tailor-made mail-merging are included in Spellbinder, using the Macro approach, in Framework and some other integrated packages, and in programmable databases such as Superbase on the Commodore 64 and newer Apples.

Doing it on the cheap

IF YOU ARE a truly lousy typist, any word processor may be better than nothing. At least it will help you to turn out a mistake-free letter. For regular use, though, there is a minimum below which no sane person would drop. The systems mentioned here all come above that minimum. Though not up to professional office standards, they serve well for serious home applications, for small businesses operating on a shoestring, and for hard-up authors and journalists.

In order to word process you need a disc drive or two, or at a real pinch a Microdrive; cassette storage will not do. Add to that the cost of the computer itself, a monitor, a printer and possibly extra cables and interfaces. Budget for all these, and for your program. Do not economise too much on the program; a good program with a cheap printer is better than a lousy program and a more expensive printer.

To start with the cheapest of the cheap, the only WP program under £20 that I have ever tested and would use myself is Tasword 2, which runs on the Spectrum and Spectrum Plus. It sets up a 64-column screen which is just legible on a portable TV and handles interfacing with Centronics printers.

Though not sophisticated, it does make editing practicable. Using Tasword 2 with Microdrives and a cheap matrix printer you could set up a basic system for somewhere around £500. A full 80-column version of Tasword, called Amsword, is also now available for the Amstrad CPC-464.

I have tried many other cheap programs for home computers, and cannot recommend any of them. They make editing a real chore. Even the more passable in the £20 to £40 range, like Wordsworth on the BBC and Simply Write on the Commodore 64, are markedly less efficient than those costing more.

Commodore 64

The drawback of the Commodore 64 is its 40-column screen. It is possible to get an 80-column adaptor, but it is expensive. Doing 40-column word processing is much harder work than using 64 or 80 columns as you never see all of what will appear in print at once, in its final layout. Its substantial memory makes the Commodore 64 a fair, cheap word-processing computer. I recommend a non-Commodore printer with an interface. The interface may cost up to £100, but you can keep using the printer when you upgrade the computer, as you surely will. Unfortunately, there is no practicable alternative to the dreadful Commodore disc drives.

Several 64 programs do not provide wordwrap, which makes reviewing text more difficult. Otherwise, the standard is generally good. Vizawrite is my own favourite: it has wordwrap, scrolls sideways, reformats quickly and easily, and reads files from other programs. Easy Script is also very usable. The all-time turkey is Quick Brown Fox — not recommended at all.

Atari

The Atari machines have never figured seriously as serious home or cheap office micros in the U.K. But their prices are low, their word processors good, and their disc system a great improvement on Commodore's. Among the worthwhile offerings are Atariwriter and Bank Street Writer.

BBC

If only the BBC had more RAM free, it would be a clear winner even at its exorbitant price. As it is, 80-column word processing is only possible with a memory extension like the Aries RAM board, or an expensive second processor. A few programs offer 80 columns without either: however, they handle only a couple of pages of text at a time.

The ROM programs are generally the best, the easiest to use and the most expensive. Wordwise is well supported with spelling checkers, language extras and the like. It is simple, fairly powerful and reliable. View has recently been improved and scores for its handling of form letters. Merlin Scribe copes with long files on disc. All three are recommended.

QL

QL word processing currently means Quill, the Psion program bundled with the machine. It has been much maligned, and indeed the early versions were too bug-ridden and too slow to be recommendable.

However, the program is superbly designed, with clear menus, good help facilities, sensible editing commands and an excellent and versatile screen display. If the faults are reduced on subsequent issues, Quill could yet make it as a major contender in this field.

CP/M

With the switch from eight-bit to 16-bit machines in the business market, the original eight-bit CP/M operating system has gone down-market. The Z-80 based computers supporting CP/M are not much more expensive than the more home-orientated micros mentioned, and they make excellent choices as cheap word-processing engines.

Quantities of competent CP/M word processors emerged in the late seventies and early eighties, and most of them compare very favourably with the home-computer opposition. The drawback is the price. Hoary old WordStar for CP/M still costs £295, which is way out of line with the likes of Wordwise at £46. Hence it makes a lot of sense to locate a bundled package with word processing, spreadsheet and the like thrown in.

An obvious choice as a cheap CP/M micro is the Amstrad CPC-464 with a disc drive, but there are no freebies currently on offer here, which is important. The Sanyo MBC, for example, costs around three times as much on the surface, but the difference is much less when you add on disc drives; WordStar and many other goodies also come free with the Sanyo. Another option is the BBC Micro with an Acorn or Torch Z-80 second processor. Both provide bundled software.

WordStar is not easy to learn, but it is powerful and very reliable. A great many letters, articles and books — mine included — have been written using it. I prefer it to the opposition, but most of the popular programs are perfectly adequate.

Bargain basement

If you have no urge to run 1-2-3 or other recent marvels on your micro, you can find bargains among outdated CP/M machines. Be cautious in arranging servicing deals, particularly with bankrupt stock or second-hand machines, unless the computer is so cheap that you can afford to throw it out when it goes wrong.

Tandy has recently offloaded much of its stock in the wake of the recent Apricot tie-up, and can be relied upon to keep servicing its products efficiently. Some Tandy computers may still be around at rock-bottom prices. Most of the bigger machines run CP/M or MS-DOS, but on those that do not Scripsit is a worthwhile in-house alternative. PC

On the move

Waiting time can be made productive if you take your computer with you. Jack Schofield investigates word processing on a portable.

DG's battery-powered One runs full-scale office word processors.

IF YOU SPEND much time in airports, railway stations, small hotels or travelling in the back of a cab, a portable micro can quickly pay for itself by turning wasted time into productive time. One of the ways it can do this is by providing the opportunity for text entry, or even word processing, while on the move.

Portables vary greatly in range and power — see Top Ten Portables on page 99. However, they can all be used for word processing, as long as they have a good-quality keyboard. The other useful attributes for word processing on the move are battery power, a legible screen and a ROM-based word-processing program. A built-in modem can also be an advantage, but because of the time and cost involved in securing approval for modems they are not as common as they might be.

Batteries for mobility

Battery power is important because the need to rely on mains power greatly restricts the range of places in which a portable can be used.

Screen legibility is especially important. Most portable micros use LCD, liquid crystal display, screens which are not self-illuminated like standard monitors and electroluminescent displays. The legibility of an LCD screen depends almost totally on the quality of the ambient lighting. The lighting in trains, boats, planes and even hotel rooms is generally far below office standards.

A ROM-based word-processing program is also a great advantage because this makes the software instantly available. With some machines you can be ready to type a document within two or three keystrokes of turning the power on.

With ROM-based portables, the text is often held in battery-backed RAM, which also adds to the convenience. When you need to stop writing you can just turn the power off, without needing to save the text to tape or disc. It is saved automatically for as long as the batteries last.

The major disadvantage of this approach is, of course, that RAM quickly gets full, which is where the modem comes in. Using a modem or an acoustic coupler with an ordinary telephone you can upload your documents either to a public electronic mail service such as Telecom Gold, or to another computer fitted with an auto-answer modem at your home or office.

However, if this is not possible, a portable micro will save documents to a standard cassette recorder. Some of the Walkman-type personal stereo products and microcassette recorders intended for dictation can be used instead, as long as a suitable cassette cable is available.

At the simplest level, a portable micro can be used as a text-entry device for typing in notes, parts of reports and the substance of letters. Using a null modem cable — a modem cable with lines 2 and 3 crossed — the text can later be transferred to a desk-top machine for word processing and the final printing out. There are two reasons for adoptiong this approach. First, portables tend to have only small screens. Second, ROM-based word processors tend not to have very many facilities, especially when it comes to print formatting.

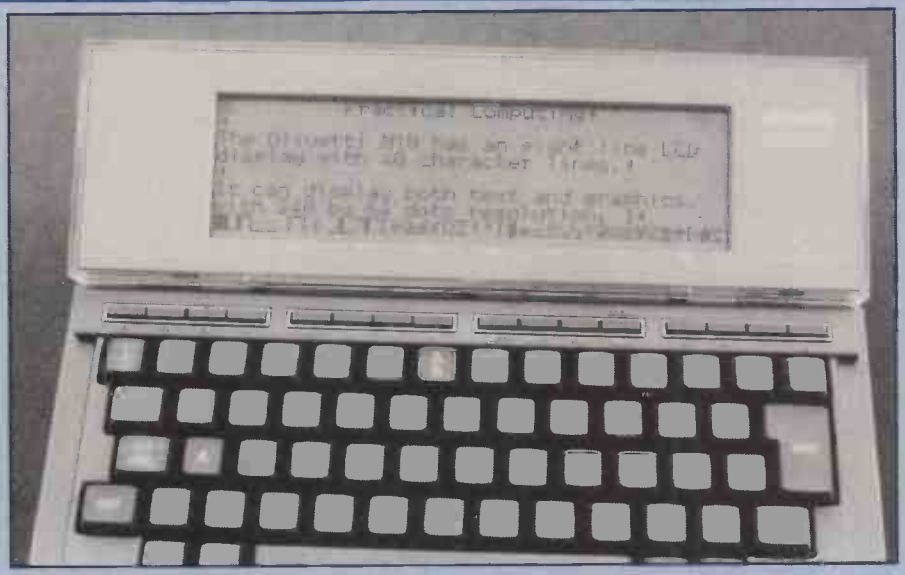
Only 50 words

The main limitation of lightweight portables like the Kyocera-built Tandy 100, Olivetti M-10 and NEC 8201a is that the screen provides only eight lines of 40 characters. This means you can only see about 50 words at once — roughly a single paragraph. The narrow width makes it difficult to compose anything which requires a formal layout. A business letter, for example, will normally be at least 64 characters across and be laid out to print across 80-column paper. The limited depth of only eight lines makes it difficult to compose a report of any length, simply because of the difficulty of seeing the overall shape and scope of your work.

The word-processing programs built into small portables like the Tandy 100 and Olivetti M-10 do not offer all the features of, say, WordStar. This is hardly suprising as they pack the word processor, a simple file-handler, the Basic language, an operating system and a telecommunications program into a mere 32K. Thus they provide only for relatively simple text operations such as Save and Load, Find, Select, Cut, Paste and Copy. The cursor can be moved by letter, by word, by line and by a screen at a time, but not by sentence, by paragraph or by page. You can jump to the top or the bottom of a text, but finding anything in the middle can be tricky. One technique is to use Find to search for a remembered phrase.

If more sophisticated facilities are required, they can be added by loading a program from tape. If the text has already been entered you can use Autopen from Microtime International, or M-10/Texted from Olivetti, to format it for printing. There are also numerous enhanced word

WordStar will run on the Epson PX-8; the 80-column screen is a major plus.



The Kyocera-built portables are light and cheap, but the display is restrictive.

processors such as Travelling Writer from Microtime International, and M-10/Word from Olivetti. Most of the Microtime packages run on all three Kyocera-made machines.

If you use your portable to send electronic mail or telexes via, say, Telecom Gold, the lack of formatting facilities is unimportant. Electronic mail is sent as a stream of ASCII characters, and the shorter the better. Formal letter layouts are not required; in fact they are a distinct disadvantage.

If your writing has a rigid structure, a portable can be used even for long texts. For example, I wrote a 5,000-word glossary for a book quite easily on an Olivetti M-10. The entries were in alphabetical order, so they were easy to find, and almost every definition was less than a screenful of text. Moving from section to section using Find was particularly easy. Of course, writing a 5,000-word feature would be a completely different matter.

There are now a number of portable micros on the market which provide virtually the same facilities as a desk-top model, and may indeed be software compatible. Examples include Data General's One and Toshiba's T-1100, both of which emulate the IBM PC, albeit using a 3.5in. disc instead of the standard 5.25in. size. The advantage of these machines is that they have a full-size screen which displays 80 characters by 24 or 25 lines. This means standard software can be run with little or no modification, which makes a powerful program such as WordStar the obvious choice for word processing.

Thus word processing on the move can be achieved without sacrificing any of the main facilities of word processing in the office. However, there are three major disadvantages. First, LCD technology is simply not up to the task of providing a legible 80 by 25 screen. Even the Data General screen, which is divided into four sections to speed up the display, is practically unusable for word processing in all but the best lighting conditions.

Second, the more powerful portables are inevitably much heavier at around 10lb. instead of around 4lb. While they are certainly small enough to fit into a briefcase, they are much too heavy to carry around all the time. In my experience even the lightweight portables like the Kyocera models can become a burden if you have other things to carry, and anything that discourages you from taking the machine along somewhere defeats the purpose of the exercise.

Expensive peripheral

Third, the full-screen portables are too expensive for most people to buy as a second machine. Yet the limitations of LCD technology mean they are simply not good enough for use as the sole or main machine. Prices are in the £2,000 to £3,000 range, instead of £300 to £500, which is a lot of money for what is essentially a peripheral.

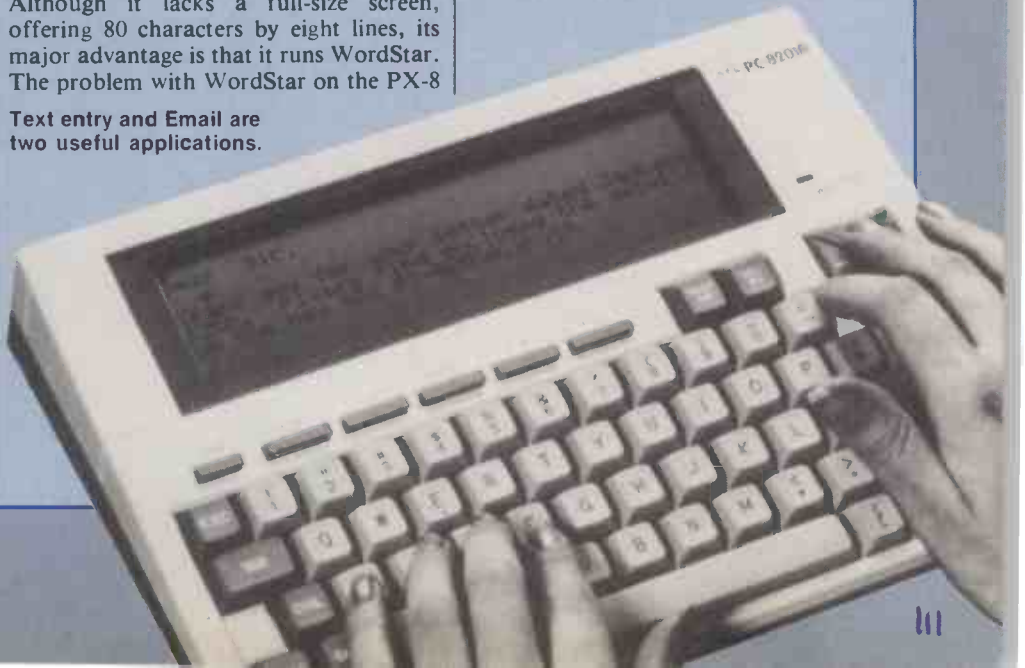
The other major competitor in the marketplace, the Epson PX-8, suffers from the same problems only less so. In size, weight and price it comes between machines like the Tandy 100 and the One. Although it lacks a full-size screen, offering 80 characters by eight lines, its major advantage is that it runs WordStar. The problem with WordStar on the PX-8 is that like its brethren on larger machines it insists on keeping .Bak, or backup, files of everything, and this unnecessary duplication of files rapidly fills the available RAM store.

If you are looking for a machine just to use for word processing on the move, the PX-8 therefore offers no great advantages over the cheaper machines for its extra weight and cost. However, the PX-8 is certainly more sophisticated and more powerful, and if other tasks have to be done as well, such as running a small accounts program, spreadsheet or vertical-market package, it does offer real advantages.

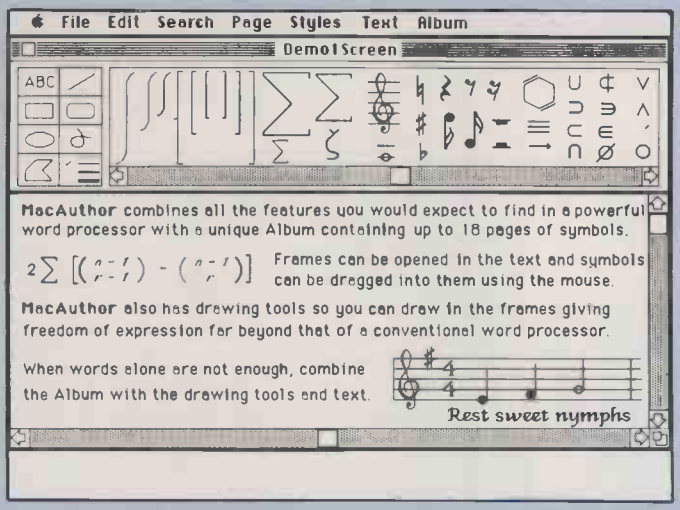
Most computer manufacturers see a large potential market for portable micros, both for word processing and other simple tasks. Insurance agents, teachers, journalists, scientists and engineers, programmers and practically every type of salesperson are reckoned to be potential purchasers. However, the technology still has some way to go, particularly from the point of view of producing more legible screens. There must also be further attempts to reduce the size and weight of these machines.

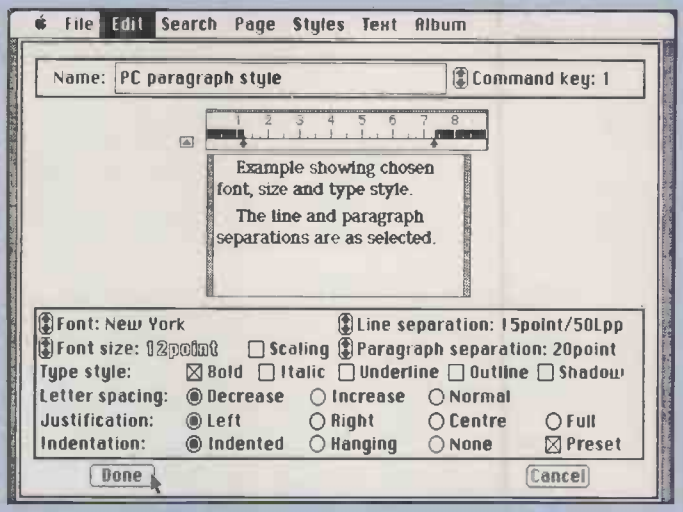
Certainly it should be possible to make portable micros that are lighter and thinner than they are today. However, the major constraint on size is the keyboard, which has to be close to normal typewriter size if you want to type on it. Thus from a practical point of view, machines like the forthcoming Tandy 200 and NEC 8401a Starlet represent close to optimum facilities for word processing on the move, and even then the advantages over existing models like the Tandy 100, Olivetti M-10 and NEC 8201a are at best marginal.

Therefore it would seem that the next breakthrough will come when the keyboard can be dispensed with — and that means voice entry. Voice recognition and other artificial intelligence projects are under way with the aim of producing speech-to-text software. There are mighty difficulties, and a portable solution looks at least a decade away. PC



Text entry and Email are two useful applications.





Macintosh alternatives

Apple supplies the Macwrite word processor with every Mac it sells, so competing products start at a disadvantage. Ian Stobie looks at what's on offer.

ON ANY OTHER machine Macwrite would be regarded as an outstanding program. It is easy to use and it is powerful. It lets you use a large number of different founts in sizes up to 24 point and even lets you incorporate pictures in your documents. What it shows you on the screen is almost exactly what it prints. Most important of all, both Macwrite and its picture-drawing companion Macpaint are included in the Macintosh system price.

But Macwrite does have some limitations, and as a result several companies are bringing out rival word processors. The most innovative of them is probably Macauthor, which is scheduled to go on sale in April. We have been looking at an early pre-release version, which although incomplete has given us a good idea of the distinctive features of the package.

Macauthor is intended mainly for people who want to produce attractive newsletters, reports and documentation. The intended users include businesses, university researchers and individual authors. Macauthor offers a great deal of control over the appearance of the finished output, which in many cases ends up being photocopied or printed at the local instant-print shop.

Like Macwrite, Macauthor is a WYSIWYG word processor. The Macintosh can easily display a whole range of print effects on its high-resolution screen; what is different about Macauthor is how you control them.

The key feature of Macauthor is the styles editor. It lets you define on-screen up to 18 different headings, paragraph and highlight styles. For instance, you could define your first heading style as 18 point Athens bold, centred, condensed and underlined, while your first paragraph style could be 12 point Geneva justified. Having defined these two styles you can then associate a command key with each one.

Styles are the equivalent of Macwrite's rulers but they allow much more control. They are also much quicker to use when you are editing a document. In Macwrite if you have several different styles of text within a document you have to copy a ruler to the beginning of each passage of text. With Macauthor you just position the text cursor anywhere within the paragraph, heading or even word that you want restyled, and hit the appropriate control key.

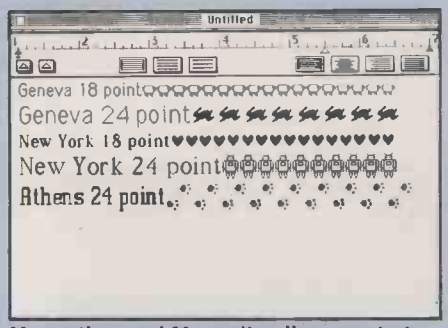
The other advantage of the styles approach compared to rulers is that a single change to a style definition changes every occurrence of text in that style throughout the document. For instance, to change all centred headings to justified left in Macwrite would mean changing the rulers for every heading; in Macauthor you have just to change one style sheet.

The styles editor gives you control over justification, tab and margin settings, fount, fount size, and fount style — that is, bold, italic, underline, shadow or outline. You can also condense or extend a type fount and alter the separation between lines and paragraphs. Adjustments to vertical spacing are made in increments of 1/72in., which is the unit used by most printers.

The styles editor does not just control the style of paragraphs and headings; it also gives you several options for high-

Macauthor specification

Document length: maximum 698 pages depending on disc capacity
Multiple-document processing: up to four documents may be open at a time, information is transferred between them with Cut, Copy and Paste commands
Founts: all Mac founts supported in normal, bold, italic, underline, outline and shadow; founts can also be used condensed, expanded and as superscript or subscript; two additional founts, Warwick Scientific and Greek are supplied with package; compatible third-party founts are already on the market for Macwrite
Styles: styles menu holds standard formats for paragraphs, headings and highlights; you can change fount, fount style, fount size, margins, justification, tab settings, line and paragraph separation
Album: contains up to 18 pages of small pictures or symbols up to 1in. square which can be dragged from album window into documents; larger images can be transferred via the clipboard from Macpaint documents
Tables: displays numeric data in columns, optionally lined up on decimal point
Hardware requirements: 128K or 512K Macintosh and Imagewriter-compatible printer; hard discs, separate numeric keypad and Apple laser printer also supported
Price: around £170
Availability: scheduled for April
Author: Icon Technology Ltd, 9 Jarrold Street, Leicester LE2 7DH. Telephone: (0533) 546225
U.K. distribution: Probe International, 78 Victoria Road, Widnes, Cheshire WA8 7RA. Telephone: 051-423 6666



Macauthor and Macwrite allow you to try out a variety of different layouts, experimenting with type sizes and founts, then give the best one to a typesetter if you still want to get work done professionally but do not know typesetter's jargon.

lighting individual words. Again, these are all invoked with a single control key while you are actually typing in or altering your document. All user-defined style definitions are automatically added to a styles menu. This means you have the option of selecting them from a pull-down menu in the usual Macintosh fashion instead of hitting a control key.

Macauthor also deals with pictures in a more flexibile way than Macwrite. The bundled Apple word processor does not allow you to have pictures and text on the same line but with Macauthor you can. The procedure is to first click on Make Frame in the page menu and then drag diagonally with the mouse. This opens up a rectangular frame in the text and the words already there automatically move out of the way to accommodate it. You can then either leave the frame empty or copy a picture into it from the clipboard. Frames can be of any size up to the page size, which is itself user-definable.

Leaving a frame empty is something you might want to do if you are taking your Macauthor output down to a printer, who can paste artwork or correctly screened photographs into the gaps. If you are not doing this then you can get images you have drawn yourself from Macpaint. Also you can use an image taken from one of the many picture-library discs available from third-party suppliers such as Mac the Knife, Click Art, and da Vinci Buildings, Landscapes and Interiors.

Macauthor provides an additional and very convenient way of dealing with small pictures less than 1in. square. Macauthor's own internal library for frequently used symbols, known as the album, can be up to 18 pages long. The library editor works like Macpaint's Fatbits and lets you draw very detailed small shapes.

To get symbols from the album you first click on a pull-down menu to bring up the album window, which takes up about the top third of the screen. A scroll bar lets you flip through the album to the relevant page. Then, as you continue editing your document, you use the mouse to drag down copies of the symbols from the album as required, and position them in your text. At the left of the album window is a set of eight drawing tools similar to the larger set contained in Macpaint. You can use them to draw in any frame you have opened in your text.

Normal text editing works much like Macwrite. Since we had a very early pre-release version of the product to look at, it was not possible to form any valid impression of how fast the release version of Macauthor will be. One crucial difference in the way a copy typist and an author use a word processor is in the number of modifications made: the author is likely to make many more. This can slow down many word processors and is a good thing to test if you intend buying a word processor for writing. PC

Macwrite: problems and plusses

Macwrite severely limits document size because it holds the document which you are currently editing entirely in memory. On the 128K Mac you can typically get no more than nine or 10 pages of single-spaced A4 text in a document, and the figure is even lower if you have incorporated several pictures. On the 512K Fat Mac the situation is better and 40-page documents are possible. None of the rival word processors coming out for the Mac suffer from this problem as they split long documents between disc and RAM.

However, Apple has already developed a new, disc-orientated version of Macwrite which allows much larger documents. It will probably be released in the U.K. sometime in April. Apple U.K. assures us that existing Macintosh owners will be able to get the upgrade from their dealers for a nominal sum.

There is a little-known but very simple way of generating graphics symbols for inclusion in Macwrite or other word-processing documents. Each Mac fount includes a variety of undocumented graphics characters which can be typed in directly from the keyboard. These were first described in the excellent American magazine *Macworld*, and are not mentioned in Apple documentation.

To see the graphics characters you need to press the Option, Shift and # keys at the same time. Having typed in a few characters try changing them to different fount sizes: the graphics symbol may well change since each fount has two or three associated with it at different sizes. These undocumented keyboard characters can also be used in Macpaint, where you can produce them bigger.

Other word-processing options

Microsoft Word was announced some time ago for the Mac and has been severely delayed. But we are pleased to say it does definitely now exist, and we received a copy as we went to press. From a quick look it seems likely to appeal most to business users as it is strong on traditional secretarial word-processing tasks. Word was first released for the IBM PC towards the end of 1983.

Word is a WYSIWYG word processor like Macwrite, with multiple founts displayed on screen; it also lets you have several documents open at the same time. For Mac users most of this is familiar territory, but for IBM users the multiple founts, the windows, along with an optional mouse interface, probably still make Word a great step forward. Possibly the most appealing thing Word brings to the Macintosh user, and which might justify the expenditure of £190, is comprehensive mail-merging and boilerplating facilities.

Main Street Writer appears in Apple's *Mac Buyers' Guide* but as far as we know is not yet available. From published details it appears to be a fairly simple package offering little more than Macwrite, apart from the ability to handle large documents and have several of them on screen at the same time.

Two other Mac products with a word-processing element are Jazz and Thinktank 512. If things go according to Lotus Development's plan Jazz goes on sale in April. It is a multi-function calc/WP/graphics/database/comms product similar to Symphony.

Thinktank 512 is more an ideas organiser than a word processor. You start by typing in headings and sub-headings, and then hide text behind them. You can then print either the entire document, or selectively print text at whatever heading level you specify.

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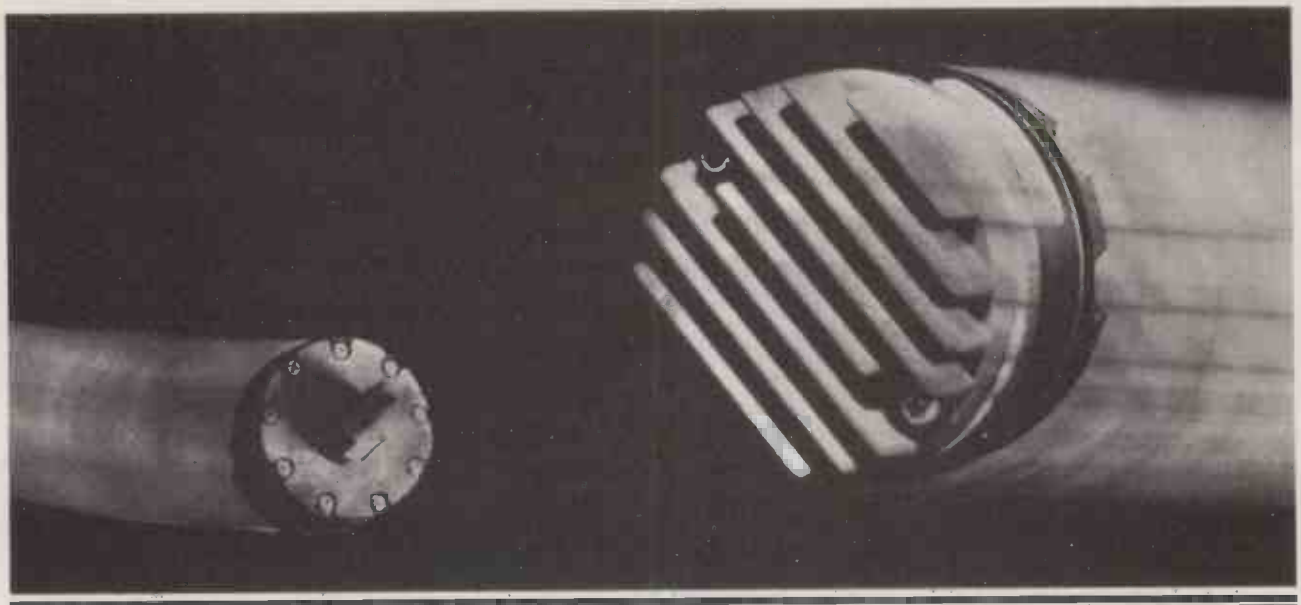

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Black Hole

Uncertainty and bluff are two crucial elements of this chess variant. David Levy proposes an algorithm capable of handling them both.

A READER once wrote to me with a suggestion for a new variation on chess. I have always found the classic game itself to be sufficiently absorbing and those variations which I have encountered did not appeal to me. Examples include Loser's Chess, which consists of trying to give away all of your own pieces; Cylindrical Chess, in which you play on a wrap-around board; and Hexagonal chess. But as I read and reread the letter suggesting Black Hole Chess, I realised that here was a variation which offered two new dimensions, uncertainty and bluff, combined in a fascinating way.

Difficult to master

The idea is simple, but to play the game well is a more difficult task than mastering chess itself. At the start of the game each player writes down the location of any one of the 64 squares of the chessboard, but does not declare it to his opponent. This square is his own Black Hole. If at any time a player makes a move on to or over his opponent's Black Hole, that piece disappears into oblivion. The opponent reveals the location of the Black Hole and removes the offending piece from the board.

For example, from the position in figure 1 White might play his bishop from f1 to c4. Unknown to him the opposing Black Hole is on d3, so his opponent reveals the piece of paper and takes the bishop off the board since it crossed the d3 square on its path from f1 to c4. The player of the black pieces now writes down another square location — it can be the same one — and this becomes his new Black Hole. In this situation a cunning player might decide that f1 is the new Black Hole, so if White tries to castle king's side he loses his king and the game because the king falls into f1 as it tries to pass over that square.

The game of chess is transformed. You can no longer analyse with certainty, since a sequence of moves which appears to win by force may result in the loss of a key piece. Furthermore, there is a big element of bluff.

In figure 2, White has just moved his rook to e1, attacking the black queen on e7. If nothing is done to parry the attack, White's next move could be to capture the queen with the rook. But if one of the squares e2, e3, e4, etc. turns out to be the opponent's Black Hole then White plays Re1xe7 his opponent will turn over the piece of paper with say, e6 written on it, and take the white rook off the board.

But the problem is not so simple. Suppose the player of the black pieces makes a move which does nothing about the attack on his queen. What is White to think? One possibility is that Black has overlooked the fact that White can take his queen with the White rook. Alternatively, White might conclude that Black is bluffing: he would never allow his queen to be captured for nothing, so he must have put his Black Hole somewhere along the file from e2 to e7.

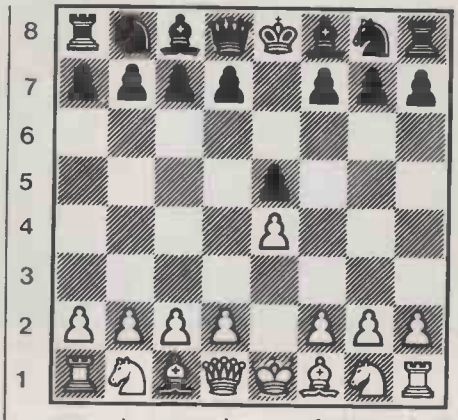

Figure 1.

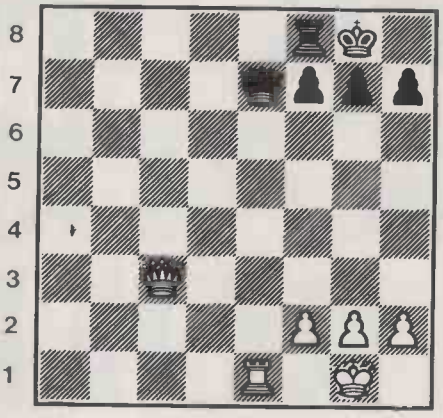

Figure 2.

It is such areas of uncertainty that make Black Hole Chess so interesting. If you do not feel sufficiently confident to try writing a strong chess-playing program, this is a game which offers scope for your programming talents on virgin ground. The chess heuristics need not be as sophisticated as those employed in a chess program, but the task is still just as challenging.

Consider how this game might be programmed using only a one-ply search, that is without any look ahead. You will need to employ an evaluation function for chess. Use the swap-off algorithm so that your program can determine, without look ahead, whether or not a particular piece may move to a particular square safely.

Next consider the probability, for each square on the board not occupied by one of the program's own pieces, that the square is the opponent's Black Hole. Denote the probabilities as P(a1), P(a2), P(a3), etc., where P(a1) is the probability that the square a1 is the opponent's Black Hole.

Score for each move

The program can determine a value for each move by multiplying the score for the resulting position as determined by the evaluation function, by the probability that the move will not result in the moving piece falling into the Black Hole. In the previous example, the value for White of the move Re1xe7 would be

[approximately 9 pawns] × [1 – P(e2)] × [1 – P(e3)] × . . . × [1 – P(e7)]

For the sake of simplicity refer to the product

$$[1 - P(e2)] \times \ldots \times [1 - P(e7)]$$

as the probability that the move Re1 × e7 is playable, abbreviated to P[Re1 × e7].

The method will work fine when there is no look ahead, and dealing with a tree search is not very much more complicated. In figure 3 the program must choose in the root position between move M1 and move M2. In reply to M1 the user may play only M11 or M12. There may be other pseudo-legal moves which would require the moving piece to move across or land on the program's Black Hole, but such moves may be ignored. If the user replies to M1 with M11, the program has the choice of M111 and M112. If this is the full extent of the search process, and evaluation takes place after three ply, the program computes a value for the terminal positions of

[apparent score for position] × [probability of being able to reach position]

where the probability of being able to reach the terminal positions are

P[M1] × P[M111], P[M1] × P[M112], P[M1] × P[M121], P[M1] × P[M122], . . . P[M2] × P[M222]

In the case of the user's moves you always know whether or not the move is playable, but in the case of the program's own moves you must make a probabilistic estimate.

This method of determining the prob-

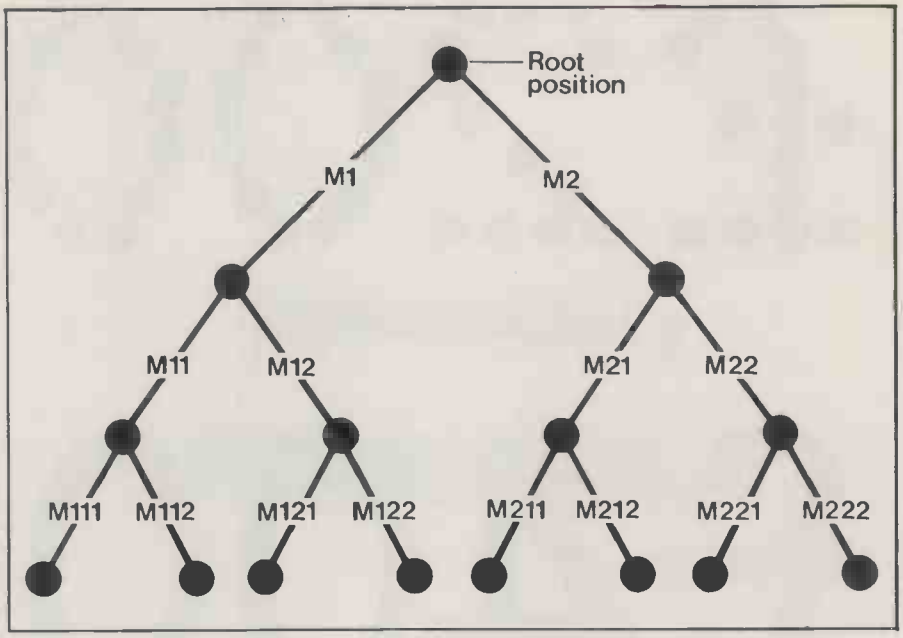

Figure 3. Simple three-ply decision tree, starting with the program's own move. Moves by the user which cross the program's Black Hole may be ignored.

ability of being able to reach a terminal position is only an approximation. To be as accurate as possible you will need to update your probability arrays after every one of the program's own moves in the game tree. For example, if the move M1 is Re1xe7 and this move turns out to be possible, the program knows that none of the squares e2, e3, . . . e7 can be the user's Black Hole. Therefore, P(e2), P(e3), P(e4), . . . P(e7), should all be set to zero. The other, non-zero, probabilities may now be normalised for those parts of the tree occurring after the move M1. This process will provide more accurate probability measures for when the program needs to calculate the probabilities P(M111), P(M112), P(M121) and P(M122).

Probability estimates

Determining the probability estimates for the various squares is not easy, and here the element of bluff must be considered. At the start of the game the program must assign estimates to each square not occupied by one of its own pieces, so if the program is White it must consider all of the squares on ranks 3 to 8 inclusive. It is reasonable to assume that the Black Hole is more likely to be on a central file rather than an edge file and that it is more likely to be on the king's wing, where castling is most likely to take place, than on the queen's wing. These estimates must add up to 1, so the final few instructions in your probability-estimation routine should normalise the probability estimates.

As the game progresses, the program can update the estimates by making use of information gleaned from its own moves. For example, if the program is White and opens with the move e2-e4, and if the user fails to remove that pawn, the program knows that neither e3 nor e4 is the user's Black Hole. It can then set P(e3) and P(e4) to 0, and normalise each of the other non-zero probability estimates. If the user responds e7-e5 and the program then plays Bf1-c4 without its bishop falling into the void, the program knows that neither d3 nor c4 can be the user's Black Hole, and so on.

As the program builds up information about which squares cannot be the user's Black Hole, so it will be able to make better use of its pieces by moving them across and on to squares that are known to be safe. In fact, if you update the probability estimates after every one of the program's own moves in the tree search, your program will sometimes make a move just to see if a particular square is safe for a more valuable piece.

The strategy your program employs to decide how to locate its own Black Hole should not be too rigid, or the user will be able to take advantage of its inflexibility. The program should determine a measure of importance for each possible square, and then choose in some random manner between, say, the eight most important squares. The importance measure could be the number of ways each square can be crossed over or moved to by the user's pieces. So in the initial position, the square a6 would have an importance count of 3 from White's viewpoint — pawn from a7 to a6, pawn from a7 to a5 across a6, and knight from b8 to a6.

Placing a Black Hole

When a new Black Hole needs to be nominated the method of assigning importance measures to each square can be made more sophisticated. For example, a tree-searching program that used the killer heuristic could perform a search from the root position on the assumption that it had not nominated any square as the Black Hole. The program could then keep track of which of the user's moves appeared most often as killers in the tree search. This information could be used to determine which squares were the most important: that is, those squares landed on or crossed over during the course of making the killer moves. The program would then be assigning importance in such a way as to make it difficult for the user to make what would otherwise be his strongest moves.

This strategy has some obvious applications, particularly in the endgame, but as the number of enemy pieces on the board is reduced, the frequency with which the program can nominate new Black Holes is also reduced. So in the endgame the program needs to think very carefully about which squares might be the best Black Holes. One obvious heuristic is that if the user has only one passed pawn, or only one pawn which might become a passed pawn, the program might well nominate as a Black Hole one of the squares over which this pawn must pass in order to reach its promotion square.

Blunder or bluff?

Finally, consider the element of bluff. How should the program assess whether the user has made a gross blunder, allowing the capture of his queen, or whether there is a Black Hole somewhere along the path? At the start of a game or playing session, the program should begin with an estimate of how likely it is that the user will bluff. This bluff factor can be randomly set between 0.5 and 0.1.

If the user makes a move which appears to leave a piece en prise, the program multiplies each of the probabilities on the capture path by the bluff factor before calculating its move. If it decides to call the user's bluff and it turns out that the user was indeed bluffing, or if it decides not to call the bluff but later discovers that the user was bluffing, then the bluff factor can be increased — multiply by 1.5 up to a maximum of 0.9. If the program discovers that the user was not bluffing, the bluff factor can be halved. This technique allows the program to adapt itself to the user's own bluffing style.

The Black Hole concept may be adapted to almost any other board game you wish. If you want to add yet another dimension you could change the rules so that the existence of a Black Hole did not automatically cause the capture of an enemy piece which crossed over or landed on the deadly square, but only did so at the discretion of the player controlling the Black Hole — though this is perhaps an unnecessary complication. PC

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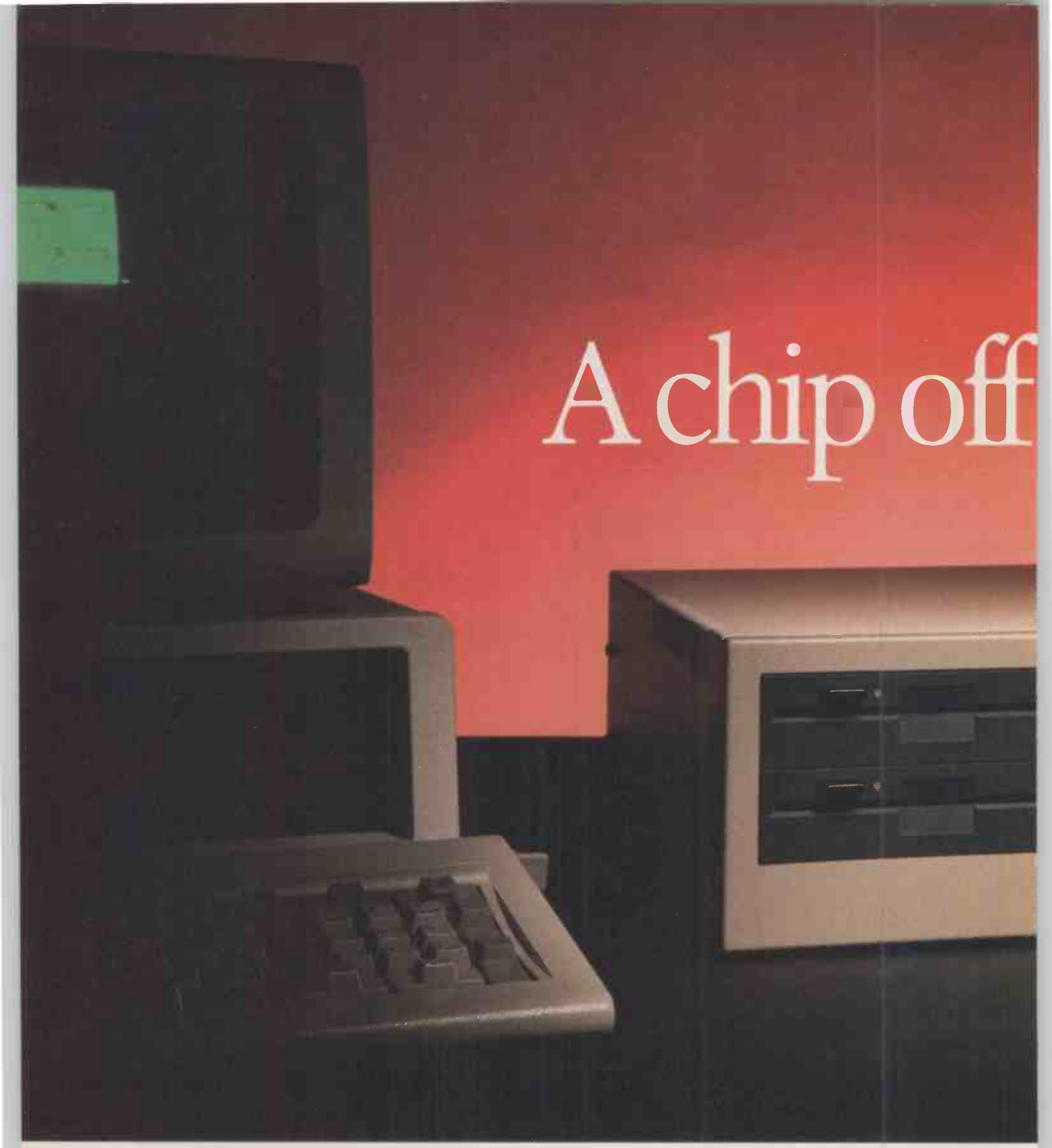

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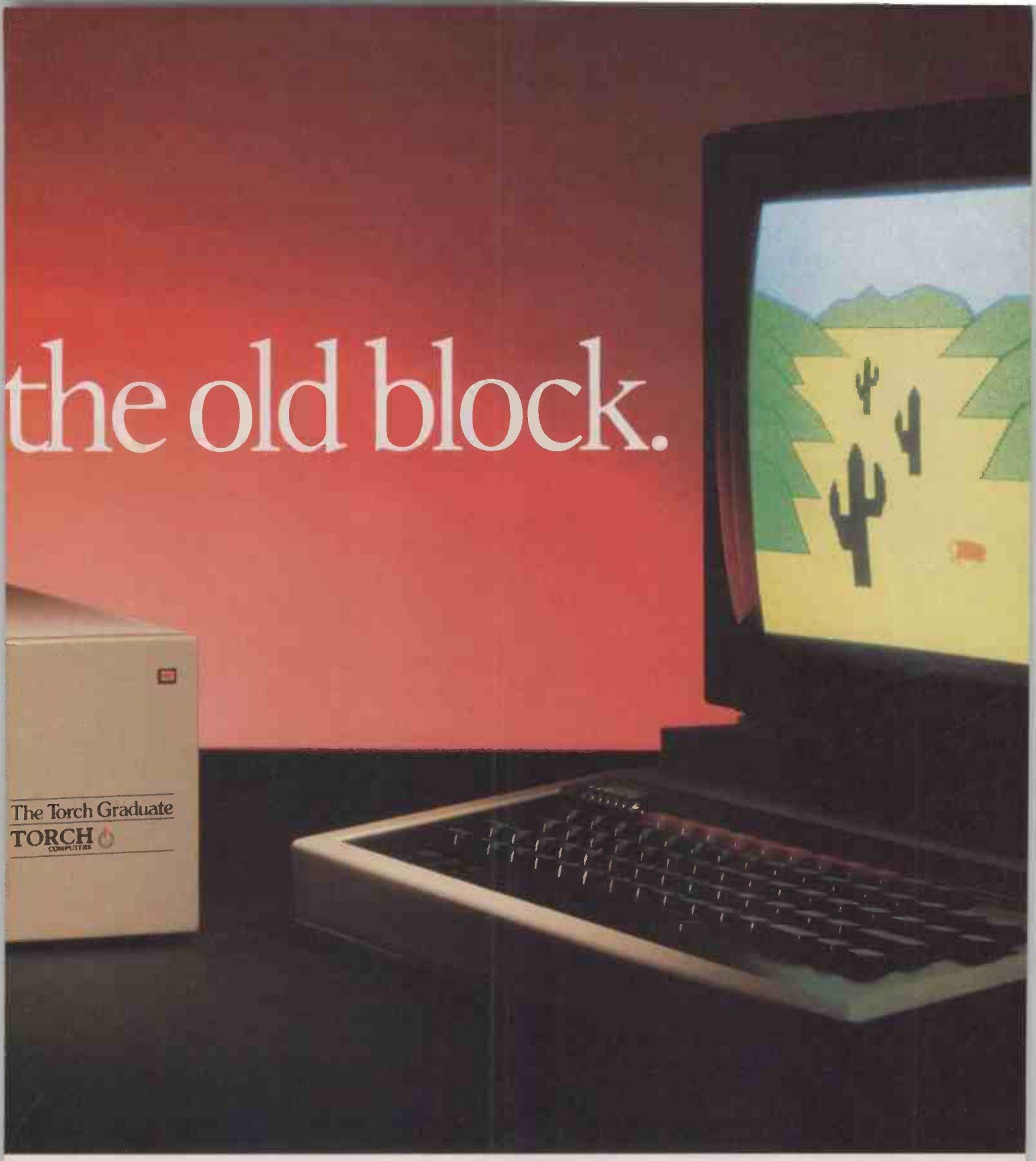

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Multi-tasking in BBC Basic

David Elworthy's kernel program allows you to run several applications at once on a BBC Micro.

A CPU can only do one thing at a time. True multi-tasking is therefore out of the question. But things move fast at processor level, so you can give the user what appears to be several programs running at the same time simply by making frequent switches back and forth from one task to another.

At its most effective, multi-tasking is implemented at operating-system level. However, it is also possible to implement multi-tasking from Basic, which is what this program does for the BBC Micro. It is not perfect: in particular, the programmer must indicate points where one program is allowed to switch to the next.

The programs or tasks may be entirely independent, or they may communicate with each other by having variables in common. A complete multi-tasking program will consist of three parts: the kernel of routines required to switch between tasks, the initialisation routines which create the test task, and the tasks themselves. Only the first two are standard, of course; the third item is the user's own program.

To write the multi-tasking kernel you must first have a means whereby an indicator can be set after a specified length of time. The individual tasks can then check this indicator to see if it is time to go on to the next task. You must also be able to save and restore pointers to where the next statement in each task is. Line numbers are not sufficient here, since you may have to switch to and from a task in the middle of a multiple-statement line.

The BBC Micro has several internal timers. One of them, the interval timer, can be set up to cause an event when its value reaches zero. An Osword call allows you to set it to any value. When the event occurs, normal processing of the Basic program is suspended, and the machine-code routine whose address is in locations &220-1 is executed. Thus, if you make the routine specified by these addresses set an indicator, the first problem is solved.

The other problem is harder, and requires a little more knowledge than the manual provides. Basic at all times maintains a pointer which contains the address of the next statement to be executed. The

Listing 1.

```
1240REM*** MULTI TASKING KERNEL ***
1250REM
1260REM This sets up the machine code routines and the various parameters
1270REM used by them
1280REM At the start of the program, include the lines:
1290REM opt=2 (or 3 if listing required)
1300REM *FX13,5 (disable interval timer)
1310REM PROCkernel(...) to create kernel

1320REM
1330REM The parameters used by PROCkernel are:
1340REM slice%=time slice for each task
1350REM This value is placed into the lower 4 bytes of the interval timer;
1360REM thus &FFFFFFFE gives slices of 2/100 seconds
1370REM tasks%=number of tasks to be included
1380REM This value must be exact!

1390REM
1400REM After PROCkernel has been called, each task must be created
1410REM This is done by going to the first line of each
1420REM in the order they are to execute.
1430REM This line must have the form:
1440REM CALLcreate%:IF?return% THEN <next task, or back to initialisation>
1450REM Once each task has been created, the system is started
1460REM by specifying the first task with:
1470REM ?next_task%=<2 * task number - 2> Task numbers are 1,2,3,...
1480REM Generally, you start with task 1, so this line says ?next_task%=0
1490REM Then start the timer by
1500REM *FX14,5
1510REM CALLtimer%
1520REM Then GOTO the first line of the
1530REM first task (i.e. the line containing CALLcreate% for that task)

1540REM
1550REM Each task must have a number of checkpoints
1560REM These are places where a change to the next
1570REM task can occur. Checkpoints are
1580REM simply the statement CALLcheck%
1590REM This will either continue with the next statement (if the slice has not
ended)
1600REM or go on to the next task (cyclically) otherwise.
1610REM Alternatively, the statements CALLevent%:CALLcheck%
1620REM always passes on to the next task
1630REM When a task is resumed, it continues at
1640REM the statement following the CALLcheck%
1650REM The first time a task is entered, it executes from the statement
1660REM after the IF ?return%=1THEN... which followed the CALLcreate%

1670REM
1680REM It is possible to fiddle it so that the next task to be executed is
1690REM the next one in sequence by the statement:
1700REM ?next_task%=<2 * next task number - 2>

1710REM
1720DEFPROCkernel(slice%,tasks%)
1730tasks%=tasks%*2:DIM task% tasks%-1:next_task%=&80:max_task%=&81:check_flag%
=&82:return%=&83:timdat%=&84
1740?next_task%=0:?max_task%=tasks% AND &FF
1750DIMsave% 130
1760osword=&FFF1:!(timdat%)=slice%:timdat%?4=&FF
1770FORc=0TOopt STEPopt
1780P%=save%:[OPTc      \save BASIC line pointer
1790 ldx next_task%:lda &B:sta task%,X
1800 lda &C:sta task%+1,X:rts
1810]
1820restore%=P%:[OPTc  \restore BASIC line pointer
1830 ldx next_task%:lda task%,X:sta &B
1840 lda task%+1,X:sta &C:rts
1850]
```

```
1860create%=P%:[OPTc   \examine task table, and assign new task if necessary
1870 ldx £0
1880.btest lda &B:cmp task%,X:beq ctest
1890 beq ctest
1900.loop inx:inx:cpx max_task%:bmi btest
1910 jsr save%:ldx next_task%:inx:inx:stx next_task%:lda £1:sta return%:rts
1920.ctest lda &C:cmp task%+1,X:bne loop
1930 lda £0:sta return%:rts
1940]
1950timer%=P%:[OPTc    \set up interval timer
1960 ldx £(timdat% AND &FF)
1970 ldY £(timdat% AND &FF00) DIV &100
1980 lda £4:jmp osword
1990]
2000event%=P%:[OPTc    \here on a 'timer crossing 0' event
2010 pha:lda £1:sta check_flag%:pla:rts
2020]
2030check%=P%:[OPTc    \see if it's time for the next task, and change if so
2040 lda £0:cmp check_flag%:bne newtsk
2050 rts
2060.newtsk jsr save%
2070 inx:inx:cpx max_task%:bne norst
2080 ldx £0
2090.norst stx next_task%:jsr restore%
2100 lda £0:sta check_flag%:jmp timer%
2110]
2120NEXTc
2130FORI%=task% TO task%+tasks%-1:?I%=0:NEXT
2140?&220=event% AND &FF:?&221=(event% AND &FF00) DIV &100
2150ENDPROC
```

Listing 2.

```
  10REM *** A Simple Multi-tasking Program ***
  20REM
  30REM David Elworthy - September 1984
  40*FX13 5
  50opt=2:PROCkernel(&FFFFFFF0,5)
  60GOTO150 :REM create the tasks
  70?next_task%=0:*FX14 5
  80 CALLtimer%:GOTO150 :REM activate the tasks
  90MODE7:CLOSE£0:END :REM return here at 'closedown'

 100REM
 110REM *** Tasks start here ***
 120REM
 130REM Task 1 - input and closedown
 140REM
 150CALLcreate%:IF ?return% THEN 360
 160MODE4:PROCwindow
 170DIM tape% 500:s%=0:e%=0: REM tape buffer
 180DIMT$(3) :REM array used for time
 190P$="":F$=""
 200reading%=FALSE:displaying%=FALSE:timing%=FALSE
 210CALLcheck%:I$=INKEY$(0)
 220IFI$=""THENCALLevent%:CALLcheck%:GOTO210
 230PRINT:REPEAT:IFASC I$=127 THENP$=LEFT$(P$,LEN(P$)-1):GOTO250
 240P$=P$+I$
 250PRINTI$;:I$=GET$:UNTIL ASC I$=&0D
 260P$=P$+CHR$ &0D
 270PRINT
 280CALLcheck%
 290IFFNparameter("X") THEN 90 :REM check for 'closedown' command
 300IFFNparameter("Q") THENCLS
 310IFINSTR("XQTOCDE",LEFT$(P$,1))=0 THENdummy=FNparameter("?"):PRINT'"Unknown
command: "C$
 320GOTO210

 330REM
 340REM Task 2 - time
 350REM
 360CALLcreate%:IF ?return% THEN 540
 370IFFNparameter("T") THEN 390 ELSEIFtiming% THEN 420
 380CALLevent%:CALLcheck%:GOTO370
 390TIME=((VAL MID$(C$,2,2) *60 + VAL MID$(C$,4,2) ) *60 + VAL MID$(C$,6,2) ) *
100
 400timing%=TRUE :REM time now set
 410CALLcheck%
 420REM here to display time
 430T%=TIME:T$(1)=STR$((T% DIV 360000)MOD 24)
 440T$(2)=STR$((T% DIV 6000)MOD 60):T$(3)=STR$((T% DIV 100) MOD 60)
 450CALLcheck%
 460FORI%=1TO3:IFLEN(T$(I%))=1THEN T$(I%)="0"+T$(I%)
 470NEXT
 480CALLcheck%:PROCtimewindow:CLS
 490PRINTT$(1);":";T$(2);":";T$(3);
 500PROCdisplaywindow:GOTO380

 510REM
 520REM Task 3 - tape input
 530REM
 540CALLcreate%:IF ?return% THEN 700
 550IFFNparameter("O")THEN 620 ELSEIFFNparameter("C") THEN 660
 560IFNOTreading% THEN CALLevent%:CALLcheck%:GOTO550
 570IFEOF£F% THENPRINT'"End of file reached":GOTO660
 580B%=BGET£F%
 590IFFNused=500 THENPRINT'"Buffer full...waiting for space":REPEAT:CALLcheck%:
UNTILFNused<500
 600tape%?e%=B%:e%=(e%+1) MOD 501
```

(listing continued on next page)

pointer is stored in locations &0B-C. Thus, by examining and adjusting the value at this address it is possible to circumvent the normal order of execution of the program.

Listing 1 shows the kernel of routines to do these two things. Most of the details are given in the Remarks, but a few supplementary comments may be useful. Lines 1720 to 1760 define a few necessary variables. Task% is a region of memory containing two bytes for each task, in which the values of the line pointer from &0B-C will be preserved. The zero page locations &80-3 are used for various parameters to the kernel routines.

Timdat%, the five bytes &84-8, contains the values to be loaded into the interval timer, thus defining the length of the time slice to be allocated to each task. The value is taken from Slice%, an argument to the kernel, and is equal to the negative of the length of each slice in hundredths of a second. For example, the value of &FFFFFFF0, or −16 decimal, makes each slice 16/100 of a second long. The interval timer is actually a 40-bit counter, but in practice the lower four bytes are sufficient for all likely applications: it limits the maximum length of a slice to a mere 2**32/100 seconds, or roughly 1.4 years. The highest byte of the timer is always loaded with &FF.

Of the six machine-code routines, Save% in line 1780 and Restore% in line 1820 should never be needed by individual tasks. They simply save and restore the Basic line pointer from a position in the task table given by Next Task%. Timer% in line 1950 sets the timer, and Event% in line 2000 is called when it reaches zero. These variables may occasionally be called from tasks, but most important are the remaining routines. Create% in line 1860 is used to bring the various tasks into existence.

At the start of each task there should be a line which says

```
CALL create%: IF ?return% THEN
  <line number of next task >
```

When called, Create% looks through the list of Basic line pointers in Task% to see if it has been called from this line before. If it has not, it records the current line pointer in the Task% table and places the value 1 in location ?return%. The If test then moves on to a similar line at the beginning of the next task, until it comes to the last task when it should be directed back into the initialisation routine. If, however, the line is being executed for the second time, Create% will place the value 0 in ?return%, the If will fail and the task starts with the next statement.

Finally, Check%, in line 2030, must be called by each task from time to time, to see if the slice has ended. If it has, the current line pointer will be logged in the Task% table and the line pointer for the next task placed in location &0B-C, so that the statement indicated by that pointer is

(continued on next page)

Basic multi-tasking

(continued from previous page)

the next one executed, rather than the one which follows the Call to this routine. The first time a task is invoked in this way, its line pointer will be pointing to the If statement in the task's first line and ?return% will be zero.

It is possible for a task to steal extra time by either calling Check% only rarely, or by altering the timer value. If a task is not doing anything, the statements

CALL event%: CALL check%

will mean that control goes on to the next task immediately, regardless of whether the slice has finished. The timer is reset to its initialisation value on a successful check, so the next task will still only get its usual slice.

An example application, shown in listing 2, illustrates what initialisation is necessary and how to use the kernel. Lines 40 to 80 contain the initialisation. Something similar to this will appear in every program which uses the kernel.

Line 40 disables timer events while things are set up. Line 50 assembles the routines, with a time slice of 16/100 seconds. Opt is used by BBC Basic's assembler: 2 specifies no listing. Line 60 sends the program to the Create line of task 1, and then through the first line of each task — lines 150, 360, 540, 700 and 820 — eventually coming back to 70 when all the tasks have been created. Line 70 indicates task 1 as being the first, and enables timer events. Line 80 sets the timer going and goes to line 150 for the second time. From now on the tasks themselves are active. Control only comes back to line 90 if a task specifically causes it.

There are five tasks, with varying degrees of interconnection. From the user's point of view, the commands available are

X — exit from the program.

Q — clear screen.

Thhmmss — set the time to hh:mm:ss. The current time is subsequently displayed in the top left-hand corner of the screen.

Ofilename — open the specified file, and read characters from it into a buffer.

C — close file.

D — display any characters in the file buffer. Characters outside the normal range of displayable ASCII are shown as their ASCII value in decimal.

E — cancel D.

(listing continued from previous page)

```
610CALLcheck%:GOTO550
620REM open file
630PRINT'"Waiting for tape...":F$=MID$(C$,2):F%=OPENIN(F$)
640PRINT"File "F$" opened"
650CALLcheck%:reading%=TRUE:GOTO610
660PRINT'"File "F$" closed":reading%=FALSE:GOTO610

670REM
680REM Task 4 - display
690REM
700CALLcreate%:IF ?return% THEN 820
710IFFNparameter("D") THEN740 ELSEIFFNparameter("E") THEN720 ELSE IFdisplaying
% THEN 740 ELSE 730
720displaying%=FALSE
730CALLevent%:CALLcheck%:GOTO710
740REM Here when displaying
750displaying%=TRUE
760CALLcheck%:IFFNused<=0 THEN 710
770D%=tape%?s%:IFD%<32ORD%>126THENPRINT"<"+STR$(D%)+">"; ELSEPRINTCHR$(D%);
780CALLcheck%:s%=(s%+1) MOD 501:GOTO760

790REM
800REM Task 5 - gremlin
810REM
820CALLcreate%:IF ?return% THEN 70
830VDU23,130,20,28,8,127,8,20,34,34: REM Define the gremlin
840GX%=1279:GY%=1023
850CALLcheck%
860VDU5:MOVEGX%,GY%:PRINT" "+CHR$(127);
870VDU4:CALLcheck%
880GX%=RND(1279):GY%=RND(1023)
890FORGI%=1TO1000+RND(3000):NEXT:CALLcheck%
900VDU5:MOVEGX%,GY%:PRINTCHR$(130);
910VDU4
920FORGI%=1TO1000+RND(5000):NEXT:GOTO850

930REM
940REM *** Miscellaneous PROCs and FNs
950REM
960 REM returns how much of tape buffer is used
970DEFFNused
980 IFs%<=e% THEN =e%-s%
990 =e%-s%+501
1000
1010DEFFNparameter(q$)
1020 LOCAL C%
1030 REM examine the parameter string to see if it starts with q$, and if so,
1040 REM remove all the characters up to the first CR into C$, returning TRUE
1050 REM q$="?" matches anything
1060 IFq$="?" THEN1080
1070 IFASC P$<>ASC q$ THEN =FALSE
1080 C%=INSTR(P$,CHR$(&0D))
1090 C$=LEFT$(P$,C%-1):P$=MID$(P$,C%+1)
1100=TRUE
1110
1120DEFPROCwindow
1130 VDU28,0,31,39,4
1140ENDPROC
1150
1160DEFPROCtimewindow
1170 dx%=POS:dy%=VPOS:VDU28,0,3,8,2
1180ENDPROC
1190
1200DEFPROCdisplaywindow
1210 PROCwindow:PRINTTAB(dx%,dy%);
1220ENDPROC
```

The various tasks divide the commands between them. Task 1 handles input and does the X and Q commands. If nothing has been typed, it does not wait around but goes straight on to task 2, line 220. However, as soon as any key is pressed, it does not allow any other task to execute until the complete line has been entered and Return has been pressed.

Task 2 allows the time to be set using the T command, and displays it once it has been. Task 3 reads from the file, and includes all necessary checks for end-of-file, full buffer, etc. The buffer of characters read may only be emptied by displaying them, using the D command. As with task 1, this may suspend the other tasks while it waits for input from the file. The C command is also handled here. Task 4 displays a character from the buffer, the D and E command.

The final task is entirely independent of the others. It causes a malicious gremlin to appear at random points on the screen and make holes in the text.

The tasks communicate with each other through a number of variables; there should be other variables in common between them. Examples are the status flags Timing%, Reading% and Displaying%, and the input string PS which, by means of FNparameter, offers the commands to each task in turn. It is advisable to call Check% after any sequence of commands that may take some time to make sure that each task gets its fair share of time. See lines 420 to 450, and 890, for example.

You must never call Check% inside a block such as a Proc, FN, Repeat-Until, Gosub-Return, or For-Next. It might be safe, but more often than not the program will end up returning somewhere unexpected. PC

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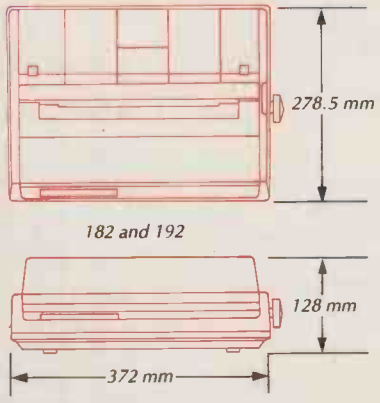

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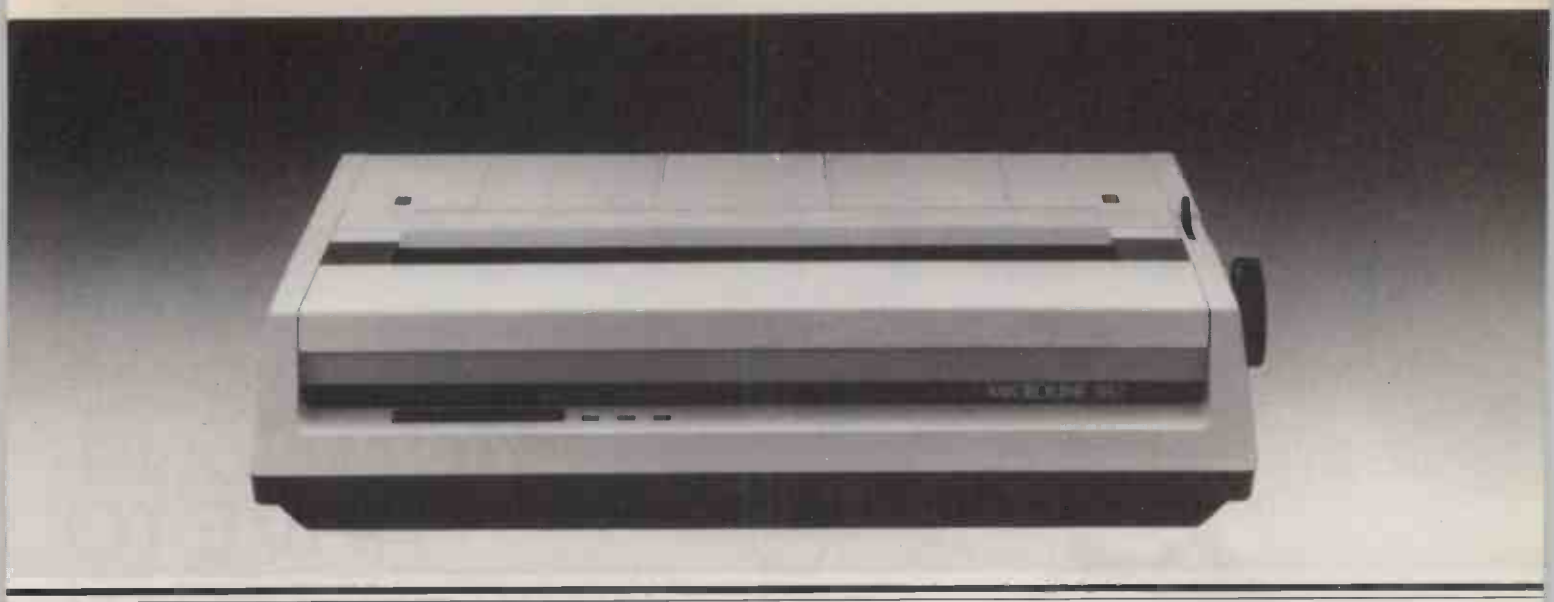

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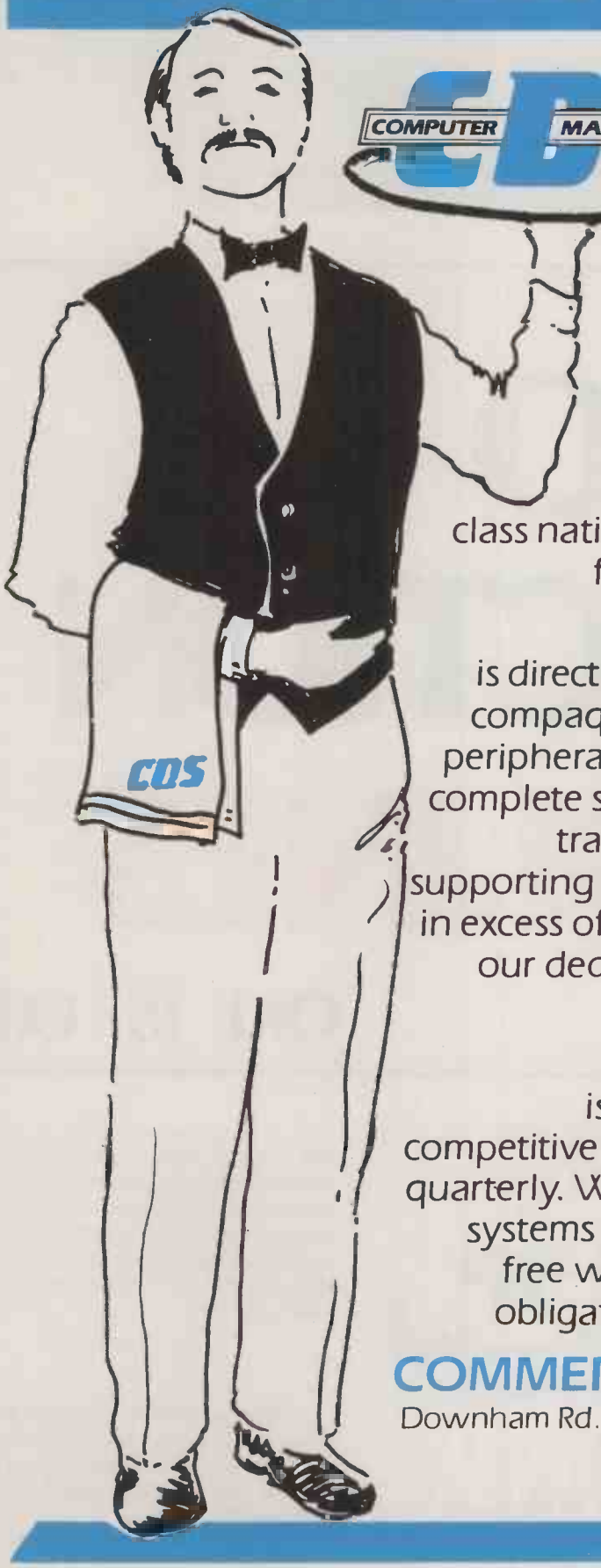

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File lister

The contents of a CP/M file can be read a screenful at a time if you use John and Timothy Lee's SList utility.

CP/M CONTAINS the intrinsic function Type which is used to list the contents of a named file on the console device. In CP/M jargon the console device is simply the terminal used to communicate with CP/M; it normally consists of a keyboard to input information, and either a printing terminal or a VDU screen to display messages and results.

The Type function was devised in the early days of CP/M, when Teletypes were commonly used as the console device. Because a Teletype prints on paper, operating at only 110 baud, it was always possible to read the information listed by Type. Today Teletypes are seldom used, except possibly as a slow and noisy printer by those who cannot afford anything better.

Console devices in current systems are likely to be either a high-speed VDU or a video interface inside the computer. On these video terminals, the Type function is inadequate because the file is usually listed too fast for you to read, and it scrolls off the screen before you can read it. Neither the Type function nor the CP/M operating system itself has any provision for paging, which would halt the listing when the screen fills up. The only way round the problem is to suspend the listing to the screen by typing a Control-S, and to resume listing by typing any character. This requires nimble finger work, and if you press any key other than Control-S then the listing is discontinued and you return to CP/M and have to start again.

Another problem with the Type function is that it sends each character from the file to the console, regardless of whether the character is printable or not. Any control characters in the file usually upset the video system, and may leave all the characters on the screen flashing or in inverse mode; they may even clear the screen. This almost always happens if you accidentially use the Type command on a machine-code .Com file. WordStar files also upset the video system, since WordStar stores print enhancements, such as Bold, Underline, Subscript, etc., as control characters.

The SList program overcomes these problems. When assembled it occupies less than 1K, so room can be found for it on most working discs. SList is used by typing

SLIST filename.extension

In just the same way as

TYPE filename.extension

is used to list a file on the screen.

SList stops listing to the screen when the screen is full, giving you as much time as you like to read the text. The bottom line on the screen displays a message which invites you either to type L to list the next line, or to type any other character to display the next screenful. You can thus scroll rapidly until you reach the part of the file you are interested in, and then advance a line at a time.

In SList long lines are handled in a predictable manner. Many 80-column video terminals automatically move to the start of a new line once 80 characters have been received, but some do not. SList will, if necessary, insert the required Carriage Return, Linefeed, and in either case SList counts the number of lines that are actually displayed, rather than the number of source lines, to determine when the screen is full.

Control characters are filtered out by SList, so there is no danger of the video being confused. Finally, after SList has displayed the entire file, a message printed on the bottom line of the screen offers the option of listing the file again.

The program listing for SList itself includes both the source code and comments in Intel mnemonics, together with the hexadecimal code produced by the CP/M assembler ASM. The following steps must be followed to produce an executable .Com file. First type in the mnemonics into a file called SList.ASM. Then type the command

ASM SLIST

to make the CP/M assembler produce a .Hex hexadecimal file. Finally type

LOAD SLIST

to produce an executable file called SList.Com.

The SList program works correctly on screens which display 24 lines of 80 characters, and automatically moves on to the next line when column 80 is used. To adapt it for other screen displays these values may be changed by altering the values of NLines, NCols and AutoLF in three lines at the start of the listing.

The SList program uses inverse video to distinguish between lines of text from the file being listed, and messages from SList itself. You could, alternatively, highlight by giving half intensity, flashing or colour, if available on your terminal. Highlighting is invoked using different codes on different terminals; those in the listing are for a North Star Advantage.

SList send two bytes to start highlighting and two bytes to stop. They are defined at the start of the SList program and are called Hi1 and Hi2, and UnHi1 and UnHi2. On the Advantage, inverse video codes are Control-A to start and Control-B to stop; thus Hi1 is set to 1 and UnHi1 is set to 2. Hi2 and UnHi2 are not needed and are set to zero. The SList program will function correctly without highlighting of any description, so if you are using a dumb terminal like the ADM-3A or if you do not know how to get highlighting on your terminal then you should set all four bytes to zero.

```
0100                    ORG     100H

                ;       Personalisable Features

0001 =          HI      EQU     01              ;Start HIghlight Code
0002 =          UNHI    EQU     02              ;Stop  highlight code
0050 =          NCOLS   EQU     80              ;Number of columns on screen
0018 =          NLINES  EQU     24              ;Number of lines on screen
0001 =          AUTOLF  EQU     1               ;Non-zero implies auto-lf
                                                ;done by terminal

0100 C33F01             JMP     START
0103 0D0A0A534C         DB      CR,LF,LF,'SLIST version 2.3'
0117 0D0A777269         DB      CR,LF,'written by T.D.Lee'
012B 0D0A446174         DB      CR,LF,'Date 7 Jan 1984',CR,LF,26

0009 =          TAB     EQU     9               ;ASCII TAB character
000A =          LF      EQU     10              ;ASCII LineFeed
000D =          CR      EQU     13              ;ASCII Carriage Return

0005 =          CPM     EQU     5               ;Address to call CP/M
005C =          FCB     EQU     05CH            ;Address of default FCB
0080 =          BUFFER  EQU     080H            ;Address of default buffer
0001 =          CONIN   EQU     1               ;CP/M CONsole INput command
0002 =          CONOUT  EQU     2               ;CP/M CONsole OUTput command
0009 =          PRINTS  EQU     9               ;CP/M PRINT String command
000F =          OPENF   EQU     15              ;CP/M OPEN File command
0014 =          READS   EQU     20              ;CP/M READ Sector command
```

(continued on page 135)

```
013F 31FC03    START:  LXI     SP,STACK
0142 CD4803            CALL    CRLF
0145 21FFFF            LXI     H,-1
0148 22D003            SHLD    PONITR

014B 3A8000            LDA     BUFFER
014E B7                ORA     A
014F 116A01            LXI     D,ERNONM
0152 CA6401            JZ      NONAME          ;Error if file name
                                               ;not supplied
0155 115C00            LXI     D,FCB
0158 0E0F              MVI     C,OPENF
015A CD0500            CALL    CPM             ;Try to open file
015D 3C                INR     A
015E C21502            JNZ     MAIN            ;Jif OK

0161 11D501            LXI     D,EROPEN
0164 CD4003    NONAME: CALL    PRINT           ;Print Error Message
0167 C30000            JMP     0               ;Reboot CP/M

016A 014572726FERNONM: DB      HI,'Error - no file name specified',UNHI
018A 0D0A0A5468        DB      CR,LF,LF,'The format for using SLIST is :'
01AC 0D0A0A0153        DB      CR,LF,LF,HI, 'SLIST filename.filetype '
01C8 3C52455455        DB      '<RETURN>', UNHI,CR,LF,LF,'$'
01D5 014572726FEROPEN: DB      HI,'Error whilst opening file',UNHI
01F0 0D0A486176        DB      CR,LF,'Have you mis-spelt the filename?'
0212 0D0A24            DB      CR,LF,'$'

0215 0617      MAIN:   MVI     B,NLINES-1      ;Line Count = 23
0217 CD1E03    MAIN2:  CALL    LINE            ;Print a Line
021A CAB302            JZ      EOF
021D 05                DCR     B
021E C21702            JNZ     MAIN2           ;One fewer line

0221 113F02            LXI     D,MNEXT
0224 CD4003            CALL    PRINT           ;Print Message
0227 CD8A03            CALL    GETKEY          ;Get Key stroke

022A 117902            LXI     D,MNEXT2
022D CD4003            CALL    PRINT           ;Remove Message from screen

0230 0601              MVI     B,1
0232 FE4C              CPI     'L'
0234 CA1702            JZ      MAIN2           ;1 Line if 'L' or 'l'
0237 FE6C              CPI     'l'
0239 CA1702            JZ      MAIN2
023C C31502            JMP     MAIN            ;else 23 Lines

023F 0D0154797OMNEXT:  DB      CR,HI,'Type L for the next line - '
025C 616E79206F        DB      'any other key for next page',UNHI,'$'
0279 0D2020202OMNEXT2: DB      CR,'                          '
029A 2020202020        DB      '                          ',CR,'$'

               ;       Jump here when End of File is encontered
S              EOF:
02B3 3E00              MVI     A,0             ;Reset File FCB by
02B5 326800            STA     FCB+12          ;setting Extent count = 0
02B8 327C00            STA     FCB+32          ;setting Record count = 0

02BB 11D102            LXI     D,MFINSH
02BE CD4003            CALL    PRINT           ;Print Message

02C1 CD8A03            CALL    GETKEY          ;Get Reply
02C4 FE41              CPI     'A'
02C6 CA3F01            JZ      START
02C9 FE61              CPI     'a'
02CB CA3F01            JZ      START           ;List again if A or a

02CE C30000            JMP     0               ;Reboot CP/M

02D1 0D0A01    MFINSH: DB      CR,LF,HI
02D4 5479706520        DB      'Type A to list the file Again, '
02F3 6F7220616E        DB      'or any other character to go back to CP/M'
031C 0224              DB      UNHI,'$'


               ;       LINE Subroutine

               ;       This Subroutine gets input Characters from the disk file
               ;       and prints them on the screen until either
               ;       i)    a LF is found
               ;       ii)   NCOLS chars have been printed, a full screen line
               ;       iii)  the End Of File (EOF) marker is found
               ;       The routine returns with the Z flag set if EOF occurs

031E C5        LINE:   PUSH    B
031F CD9503    LINE2:  CALL    GETCHR          ;Char in A
0322 FE1A              CPI     26
0324 CA3C03            JZ      LINE3           ;Give up if EOF
0327 CD4F03            CALL    OUTPUT          ;Print Char in A

032A FE0A              CPI     LF
032C CA3C03            JZ      LINE3           ;Finish if LF just printed
032F 3AD203            LDA     COL
0332 FE50              CPI     NCOLS
0334 C21F03            JNZ     LINE2           ;Continue unless Line is full

                       IF      NOT AUTOLF
                       CALL    CRLF            ;do CR LF if not done by terminal
                       ENDIF
0337 3E00              MVI     A,0
0339 32D203            STA     COL             ;Reset Col position to 0

033C C1        LINE3:  POP     B
033D FE1A              CPI     26              ;Set Zero flag if EOF
033F C9                RET


               ;       PRINT Subroutine

               ;       Print a string on the screen

0340 F5        PRINT:  PUSH    PSW
0341 0E09              MVI     C,PRINTS
0343 CD0500            CALL    CPM
0346 F1                POP     PSW
0347 C9                RET

               ;       CRLF Subroutine
```

(continued on next page)

(continued from previous page)

```
                ;       Prints CR LF on screen

0348 3E0D       CRLF:   MVI     A,CR
034A CD4F03             CALL    OUTPUT
034D 3E0A               MVI     A,LF

                ;       OUTPUT Subroutine

                ;       Print the character in the A register on the screen
                ;       unless it is a Control Character.
                ;       If character is printable increment the COL position
                ;       If character is CR reset COL position to 0

034F F5         OUTPUT: PUSH    PSW
0350 C5                 PUSH    B

0351 E67F               ANI     07FH            ;Clear Parity Bit
0353 CD7703             CALL    CONTRL          ;Test For Non-Printable
0356 CA7403             JZ      OUTPT3          ;Skip if so

0359 F5                 PUSH    PSW             ;Save Char
035A 5F                 MOV     E,A
035B 0E02               MVI     C,CONOUT
035D CD0500             CALL    CPM             ;else send to Screen
0360 F1                 POP     PSW             ;restore Char

0361 FE0A               CPI     LF
0363 CA7403             JZ      OUTPT3          ;If LF Dont change Col position
0366 FE0D               CPI     CR
0368 3E00               MVI     A,0             ;If Char is <cr>
036A CA7103             JZ      OUTPT2          ;reset Col position to 0
036D 3AD203             LDA     COL
0370 3C                 INR     A               ;else Increment Col position
0371 32D203     OUTPT2: STA     COL

0374 C1         OUTPT3: POP     B
0375 F1                 POP     PSW
0376 C9                 RET

                ;       CONTR Subroutine

                ;       Tests if character in A register is printable.
                ;       and returns with Z flag set if Character is a
                ;       Control Character other than CR or LF

0377 FE20       CONTRL: CPI     ' '
0379 F28803             JP      CONTR2          ;Jump if not a Control Char
037C FE0A               CPI     LF
037E CA8803             JZ      CONTR2
0381 FE0D               CPI     CR
0383 CA8803             JZ      CONTR2
0386 3E00               MVI     A,0             ;Return A=0 if unprintable
0388 B7         CONTR2: ORA     A               ;Set or Unset Z flag
0389 C9                 RET


                ;       GETKEY Subroutine

                ;       Get a character from the Keyboard
                ;       Reboot CP/M if it is Control C

038A 0E01       GETKEY: MVI     C,CONIN
038C CD0500             CALL    CPM
038F FE03               CPI     3               ;If it is Control C
0391 CA0000             JZ      0               ;then Reboot CP/M
0394 C9                 RET

                ;       GETCHR Subroutine

                ;       This subroutine gets a byte from disk
                ;       If the byte if a TAB character, it is expanded as
                ;       a sequence of spaces

0395 3AD203     GETCHR: LDA     COL             ;Get Column position
0398 E607               ANI     7
039A CAA403             JZ      GETCH2          ;Jump if col 8,16,24 etc
                                                ;ie a TAB position
039D 3AD303             LDA     TABFL
03A0 B7                 ORA     A               ;else if expanding a TAB
03A1 C2B203             JNZ     GETCH3          ;return a SPACE

03A4 3E00       GETCH2: MVI     A,0
03A6 32D303             STA     TABFL           ;Clear TAB FLag
03A9 CDB503             CALL    GETBYT          ;Get byte from disk
03AC FE09               CPI     TAB             ;and use it as character
03AE C0                 RNZ                     ;unless it is a TAB

03AF 32D303             STA     TABFL           ;Set TAB Flag
03B2 3E20       GETCH3: MVI     A,' '           ;Return a SPACE
03B4 C9                 RET

                ;       GETBYT Subroutine

                ;       This subroutine gets a byte from the disk file
                ;       The pointer to the file is incremented, and unless
                ;       the input buffer is exhausted a byte from it. If the
                ;       buffer is empty the next sector is read from disk
                ;       and the pointer is reset. If an error occurs when
                ;       reading from the file, ^Z (EOF marker) is returned.

03B5 2AD003     GETBYT: LHLD    PONITR          ;Get pointer to buffer
03B8 2C                 INR     L
03B9 C2CB03             JNZ     GETBY2          ;Jump if Char is in buffer

03BC 115C00             LXI     D,FCB           ;else
03BF 0E14               MVI     C,READS         ;Read next sector
03C1 CD0500             CALL    CPM
03C4 B7                 ORA     A               ;Set Flags
03C5 3E1A               MVI     A,26
03C7 C0                 RNZ                     ;Return ^Z if error

03C8 218000             LXI     H,BUFFER
03CB 7E         GETBY2: MOV     A,M             ;Get Char from buffer
03CC 22D003             SHLD    PONITR          ;Save pointer to buffer
03CF C9                 RET

03D0 8000       PONITR: DW      080H
03D2 00         COL:    DB      0               ;Start in Column 0
03D3 00         TABFL:  DB      0               ;Non Zero when expanding TAB
03D4                    DS      40
                STACK:
03FC                    END
```

PC

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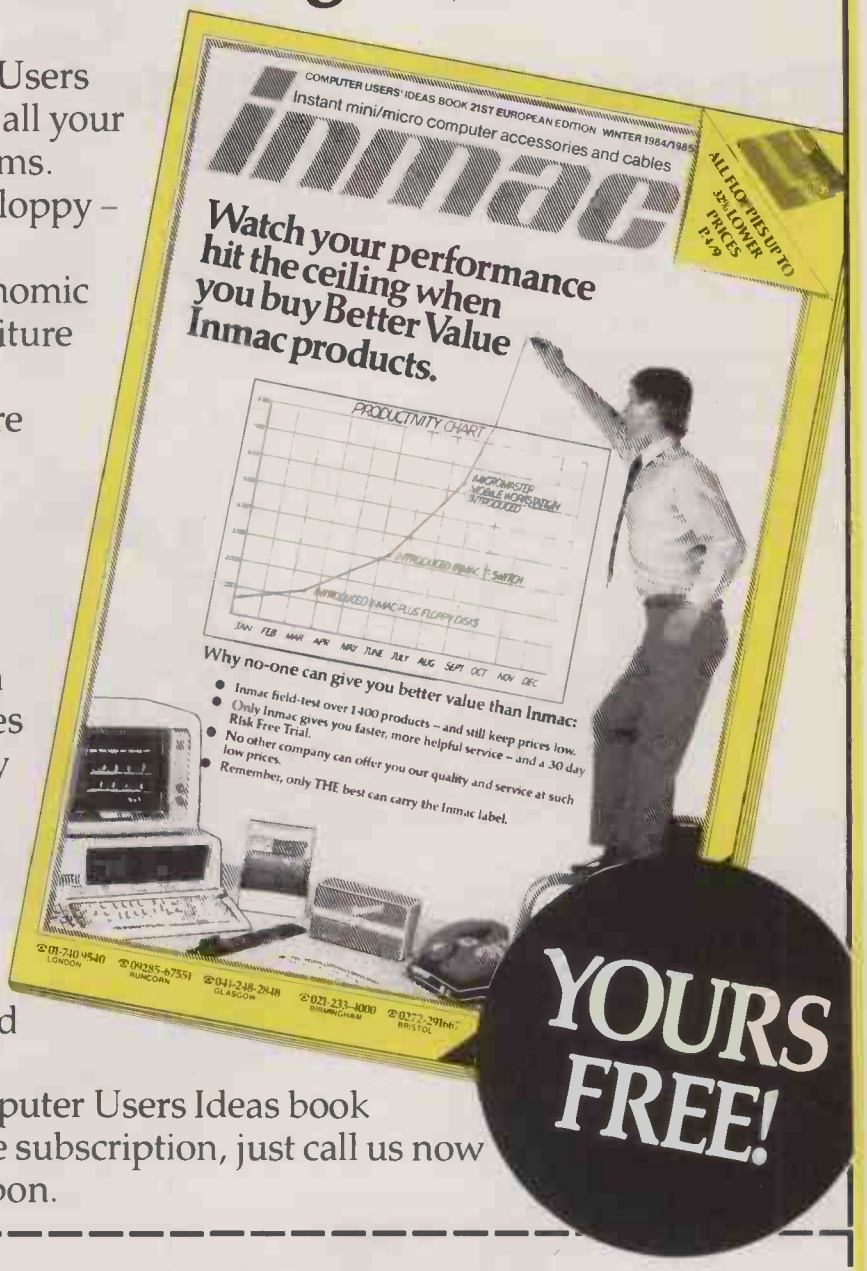

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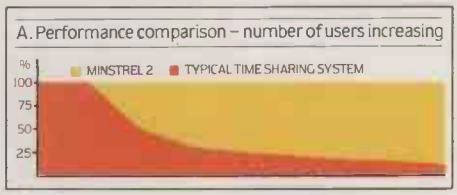

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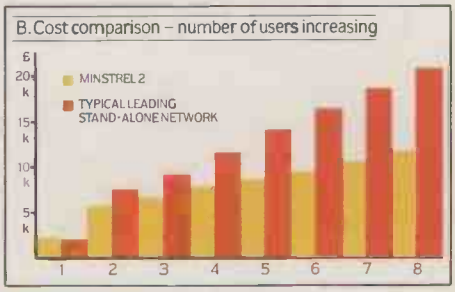

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Inside OS

Part 3 of the series in which Roger Cullis examines the routines programmed into the BBC Micro's operating-system ROM.

ACCESS to the keyboard is over a slow eight-bit data bus connected to port B of the OS VIA. Read or Write operations are selected by the data direction register. Keyboard input and housekeeping routines are held at &EEDA-F134.

The keyboard is an interrupt-driven device which feeds an input buffer at &03E0-03FF. A two-key rollover is operated; the latest key pressed is stored at &EC and the previous key at &ED. Keys generate internal key numbers which are converted to ASCII codes by a series of look-up tables, indexed by the key number from a base address &EFAB. Interposed between the conversion look-up tables are small routines requiring only a few bytes of code.

Nearly 3K of the operating-system ROM, &F135-FBFF, is devoted to the cassette and ROM filing-system routines. Due to the limited nature of these filing systems, not all of the operations or operating-system calls relating to other filing systems can be fully implemented. For example, if a * command is not executed by the operating system or one of the sideways ROMs it is passed to the current filing system, which will normally attempt to *Run the command. If no file is found within a default time limit, the filing system displays an error message. Since a cassette tape is open-ended, there is no guarantee that the file will be found within a reasonable time, so the CFS simply does not attempt to execute the operation.

The 6502 microprocessor does not have any I/O capability. Part of its address space, &FC00-FEFF, is therefore devoted to memory-mapped I/O. In the case of OS 1.2 page FC, Fred, is allocated to peripherals and page FD, Jim, to memory accessed over the 1MHz bus. Part of this is reserved for Acorn's expansions, such as a hard-disc controller or the teletext receivers, and part is dedicated to user applications. Page FE, Sheila, is concerned with internal devices and is used to service the peripheral controller chips built into the computer.

After processing a BRK instruction or an interrupt, operation may need to be resumed at the previous point, which may be within a sideways ROM. The routines to do this are held at &F00-FFA5. By rearranging the stack and storing the identity of the ROM which is active, this can be achieved.

Miscellaneous OS call entry points are held at &FFA6-FFF9. Defined entry points for OS calls are provided to ensure compatibility with future upgrades. The locations of the routines themselves will change as they are rewritten.

On NMI, Reset or IRQ, the 6502 transfers the values stored at &FFFA/B, &FFFC/D or &FFFE/F to its program counter. The operating-system ROM therefore stores the entry points of the corresponding routines at these addresses.

This article forms part of a book to be published by Losco Ltd, PO Box 4, Cranleigh, Surrey GU6 8BQ, price £11.95 plus £1.50 post and packing. A further instalment will appear in next month's *Practical Computing*.

Keyboard input and housekeeping routines.

```
EEDA      :if no key pressed, enable keyboard, reset shift lock, caps lock
EEEB      :set shift or caps lock as appropriate
EF02      :KEYV entry point - controls keyboard access
EF13      :timer interrrupt entry point
EF16      :test shift and control keys
EF74      :set keyboard status, zero autorepeat timer, scan keyboard
EFAB      :internal key number to ASCII lookup tables base address
EFC1      :check for ESCAPE, enter processed code in keyboard buffer
EFE9      :scan keyboard, save any key pressed
F00F      :key-pressed interrupt entry point
F01F      :set autorepeat countdown timer
F02A      :write-disable keyboard - write/read keyboard over slow databus
F03B-F044 :internal key number to ASCII lookup table - keys 10-19
F045      :OSBYTE 78 - write current keys pressed
F055      ;go to JIM paged entry vector
F04B-F054 :internal key number to ASCII lookup table - keys 20-29
F058      :perform indirected operation
F05B-F064 :internal key number to ASCII lookup table - keys 30-39
F065      :test if any bit set, go to KEYV
F068      :go to KEYV
F06B-F074 :internal key number to ASCII lookup table - keys 40-49
F075-F07A :MOS VIA settings for speech system
F07B-F084 :internal key number to ASCII lookup table - keys 50-59
F085      :OSBYTE 24 - read OSHWM
F08B-F094 :internal key number to ASCII lookup table - keys 60-69
F095      :set buffer number and flush it
F09B-F0A4 :internal key number to ASCII lookup table - keys 70-79
F0A5      :go to event handling routine
F0AB      :OSBYTE 0F - flush selected buffer class
F0AA      :flush all buffers
F0B4      :OSBYTE 15 - flush specific buffer
F0B9      :issue *HELP expansion service call, PRINT ROM identity
F0C1      :"OS 1.20" embedded message
F0CC      :clear carry and scan keyboard from 16 decimal
F0CD      :OSBYTE 79 - keyboard scan from 16 decimal
F0CF      :OSBYTE 7A - keyboard scan
F0D1      :scan keyboard (as OSBYTE 79)
F129      :write enable keyboard, blip interrupt enable
F12E      :write enable keyboard, transfer X- to A-register
```

CFS/RFS routines.

```
F135      :OSBYTE 8C - select CFS (*TAPE)
F135      :OSBYTE 8D - select ROM filing system (*ROM)
F140      :set OPT interblock gap to default
F14B      :initialise CFS and claim vectors
F168      :OSBYTE 8F - issue paged ROM service call
F18E      :CFS OSARGS routines - read/write whole file arguments
F1A3      :CFS OSFSC routine vector lookup table
F1B1      :CFS OSFSC routine - filing system control
F1C4      :load file
F1F6      :switch motor off and PRINT "Locked" error message
F1F9      :"Locked" error message
F246      :sound BELL and abort
F249      :PRINT newline if indicated by current block flag
F24D      :if CFS not executing operation, PRINT CR
F25A      :get filename from OS command line buffer
F27D      :CFS OSFILE routines - read or write a whole file
F290      :save load and execute addresses
```

```
F2CB        :save file to tape
F305        :CFS OSFSC call 2 - '*/' command
F305        :CFS OSFSC call 4 - *RUN command
F32B        :CFS OSFSC call 5 - *CAT command
F33B        :reset CFS status byte bit 3 (not cataloguing)
F33D        :mask A-register with CFS status byte and save it back
F342        :set CFS status byte bit 3 (EOF reached)
F344        :set specified (A-register) status byte bits
F348        :read data from CFS/RFS
F3CA        :CFS OSFIND routine - open or close a file
F3D4        :close files
F3D7        :close all open files
F3F2        :open a file for access
F46F        :save file status, restore registers
F471        :restore X-,Y-registers, copy file status to A-register
F478        :if enabled, write final block, close file
F496        :set up header, save block to tape
F4C9        :CFS OSBGET routines - read one byte from file
F523        :"EOF" error message - error code DF
F529        :CFS OSBPUT routines - write one byte to file
F588        :communicate with current filing system (CFS/RFS)
F54D        :CFS OSFSC call 0 - *OPT
F561        :*OPT 1,n

F568        :*OPT 2,n
F573        :*OPT 3,n
F581-F587   :*OPT setting bitwise lookup table
F588        :communicate with current filing system (CFS/RFS)
F61E        :CFS @SFSC call 1 - check EOF
F631        :search for file
F637        :search for specified block
F61E        :CFS OSFSC call 1 - check EOF
F644        :"Searching" embedded message
F674        :"File not found" error message - error code D6
F6BB        :read from EXEC file
F6BD        :close EXEC file if open, read from specified file
F6AC        :seek BGET file, read block
F6B4        :read block from BGET file
F723        :"Bad ROM" error message - error code D7
F77B        :read block header
F797        :get character from file, do cyclic redundancy check
F7B0        :perform cyclic redundancy check
F7D5        :reset flags
F7D7        :set flags
F7EC        :write block to tape
F875        :transfer byte to CFS, do cyclic redundancy check
F87B        :save checksum to tape, reset buffer flag
F882        :save byte to buffer, transfer to CFS, reset flag
F884        :when buffer/ACIA transfer done, reset flag, transfer buffer to
            :A-register
F892        :generate 5 second delay
F896        :generate delay set by interblock gap
F89B        :generate 0.2 second delay
F8A9        :if not first or last block, ....
F8B6        :PRINT CR if indicated by current block flag, then ....
F8B9        :update block flag received, PRINT filename (+ address if required)
F8CD        :PRINT filename from CFS header block
F8EB        :pad filename out with trailing spaces
F915        :PRINT four spaces, execute address and load address
F927        :PRINT four bytes from CFS block header
F934        :prompt to start recording
F94A        :"RECORD then RETURN" embedded message
F96A        :increment current load address
F975        :PRINT a space, then ASCII equivalent of hexadecimal byte
F97A        :PRINT ASCII equivalent of hexadecimal byte
F983        :convert hexadecimal digit to ASCII and PRINT it
F991        :PRINT a space
F995        :confirm CFS not executing operation nor ESCAPE flag set
F9AD        :process ESCAPE call
F9AB        :"Escape" error message - error code 11
F9B4        :load file from tape
F9BA        :"CR Loading" embedded message
F9D9        :load data from CFS/rom and check validity
FA46        :if CFS not exececuting operation, PRINT embedded message
FA4A        :PRINT following embedded message
FA52        :PRINT next character
FA72        :check if header block filename matches sought filename
FA8E        :"Data?" error message - error code D8
FA99        :"File?" error message - error code DB
FAA4        :"Block?" error message - error code DA
FAC2        :"CR BELL rewind tape CR" embedded message
FAD6        :check loading progress, read another byte
FAEB        :sound BELL if enabled, switch motor off, reset serial interface
FAF2        :enable 2nd processor if appropriate, switch motor off, reset serial
            :interface
FAFC        :setup serial interface, initialise timeout counter, reset ACIA
FB0A        :save processor status and reset ACIA
FB1A        :set sequential block gap according to OPT, inter-block gap,
            :interrogate ESCAPE flag, reset timeout, ACIA
FB27        :set current message option, inter-block gap, interrogate
            :ESCAPE flag, reset timeout, ACIA
FB46        :reset ACIA
FB4A        :set ACIA control register
FB50        :switch motor on, enable CFS output, set baud rate
FB63        :set ACIA to CFS baud rate
FB69        :increment current block number
FB78        :zero buffer flag and checksum bytes
FB7C        :zero checksum bytes
FB81        :set (0030,X) as sought filename
FB8E        :enable CFS for read operation, switch motor on
FB90        :switch motor on
FB95        :switch cassette motor
FB9C        :confirm file is open
FBB1        :"Channel" error message - error code DE
FBBB        :read from 2nd processor if present
FBBD        :if 2nd processor file, set up parameter block, enable 2nd processor
            :if present
FBC7        :enable 2nd processor
FBD3        :if file for 2nd processor, test TUBE presence flag
FBE2        :set up CFS for write op
```

Fred — 1MHz bus memory-mapped I/O.

```
FC00-FC0F   :test hardware
FC10-FC13   :Teletext
FC14-FC1F   :Prestel
FC20-FC27   :IEEE interface
FC28-FC2F   :reserved for Acorn expansion
FC30-FC3F   :Cambridge Ring interface
FC40-FC47   :Winchester disc interface
FC48-FC7F   :reserved for Acorn expansion
FC80-FC8F   :test hardware
FC90-FCBF   :reserved for Acorn expansion
FCC0-FCFE   :user applications
FCFF        :paging register for JIM expansion memory
```

Jim — 1MHz bus memory expansion page.

```
FD00-FD7F   :reserved for Acorn
FD00-FDFF   :user applications
```

Sheila — OS memory-mapped I/O.

```
FE00        :6845 CRTC address register
FE01        :6845 CRTC register file
FE08        :6850 ACIA W-control register   R-status register
FE09        :6850 ACIA W-transmit data, R-receive data
FE10        :serial ULA control register
FE20        :video ULA control register
FE21        :video ULA palette register
FE30        :LS161 paged ROM identity
FE40        :MOS 6522 VIA  ORB/IRB
FE41        :MOS 6522 VIA  ORA/IRA
FE42        :MOS 6522 VIA  data direction - register B
FE43        :MOS 6522 VIA  data direction - register A
FE44        :MOS 6522 VIA  T1C-L write latches, read counter
FE45        :MOS 6522 VIA  T1C-H high order latches
FE46        :MOS 6522 VIA  T1L-L low order latches
FE47        :MOS 6522 VIA  T1L-H high order latches
FE48        :MOS 6522 VIA  T2C-L W-latches, R-counter
FE49        :MOS 6522 VIA  T2C-H T2 high order counter
FE4A        :MOS 6522 VIA  shift register
FE4B        :MOS 6522 VIA  auxiliary control register
FE4C        :MOS 6522 VIA  peripheral control register
FE4D        :MOS 6522 VIA  interrupt flag register
FE4E        :MOS 6522 VIA  interrupt enable register
FE4F        :MOS 6522 VIA  as register 1 except no handshake
FE60        :USR 6522 VIA  ORB/IRB
FE61        :USR 6522 VIA  ORA/IRA
```

(continued on next page)

(continued from previous page)

```
FE62    :USR 6522 VIA  data direction - register B
FE63    :USR 6522 VIA  data direction - register A
FE64    :USR 6522 VIA  T1C-L write latches, read counter
FE65    :USR 6522 VIA  T1C-H high order latches
FE66    :USR 6522 VIA  T1L-L low order latches
FE67    :USR 6522 VIA  T1L-H high order latches
FE68    :USR 6522 VIA  T2C-L W-latches, R-counter
FE69    :USR 6522 VIA  T2C-H T2 high order counter
FE6A    :USR 6522 VIA  shift register
FE6B    :USR 6522 VIA  auxiliary control register
FE6C    :USR 6522 VIA  peripheral control register
FE6D    :USR 6522 VIA  interrupt flag register
FE6E    :USR 6522 VIA  interrupt enable register
FE6F    :USR 6522 VIA  as register 1 except no handshake
FE80    :8721 FDC  W-command register, R-status register
FE81    :8721 FDC  W-parameter register  R-result register
FE82    :8721 FDC  reset register
FE83    :8721 FDC  W-illegal   R-illegal
FE84    :8721 FDC  W-data      R-data
FEA0    :68B54 ADLC W-control register 1 R-status register 1
FEA1    :68B54 ADLC W-control register 2/3, R-status register 2/3
FEA2    :68B54 ADLC W-Tx FIFO (frame continue)  R-Rx FIFO
FEA3    :68B54 ADLC W-Tx FIFO (frame terminate) R-Rx FIFO
FEC0    :UPD7002 ADC  W-data latch A/D start, R-status
FEC1    :UPD7002 ADC  hi data byte
FEC2    :UPD7002 ADC  lo data byte
FEE0    :TUBE FIFO1 flag
FEE1    :TUBE FIFO1
FEE2    :TUBE FIFO2 flag
FEE3    :TUBE FIFO2
FEE4    :TUBE FIFO3 flag
FEE5    :TUBE FIFO3
FEE6    :TUBE FIFO4 flag
FEE7    :TUBE FIFO4
```

BRK and interrupt-handling routines.

```
FF36    :NETV default entry point
FF56    :on interrupt, process extended vector
FF89    :discard 3 bytes from bottom of stack, switch ROMs
```

Miscellaneous OS call entry points.

```
FFA6    :CFS OSGBPB - no function implemented, contains RTS opcode
FFA6    :VDUV default entry point - contains RTS opcode
FFA6    :IND1V default entry point - contains RTS opcode
FFA6    ;IND2V default entry point - contains RTS opcode
FFA6    :IND3V default entry point - contains RTS opcode
FFA7    :OSBYTE 9D - fast BPUT
FFAA    :OSBYTE 92 - read byte from FRED
FFAE    :OSBYTE 94 - read byte from JIM
FFB2    :OSBYTE 96 - read byte from SHEILA
FFB6    :default vector table length and location lookup table
FFB9    :OSRDRM - read from paged ROM
FFBC    :VDU character output
FFBF    :OSEVEN generate an EVENT
FFC2    :GSINIT - initialise OS string input routine
FFC5    :GSREAD - read character from input string
FFC8    :NVWRCH - non-vectored character output
FFCB    :NVRDCH - non-vectored character input
FFCE    :OSFIND - open or close a file
FFD1    :OSGBPB - transfer block to or from file
FFD4    :OSBPUT - save a byte to file
FFD7    :OSBGET - read a byte from file
FFDA    :OSARGS - read or write file arguments
FFDD    :OSFILE - read or write whole file or attributes
FFE0    :OSRDCH - read character from input
FFE3    :OSASCI - output ASCII character
FFE7    :OSNEWL - start new line
FFEE    :OSWRCH - output character
FFF1    :OSWORD - execute OS routine utilising parameter block
FFF4    :OSBYTE - execute OS call
FFF7    :OSCLI  - execute command input string
```

6502 vectors.

```
FFFA    :(0D00) NMI vector
FFFC    :(D9CD) RESET vector
FFFE    :(DC1C) IRQ vector
```

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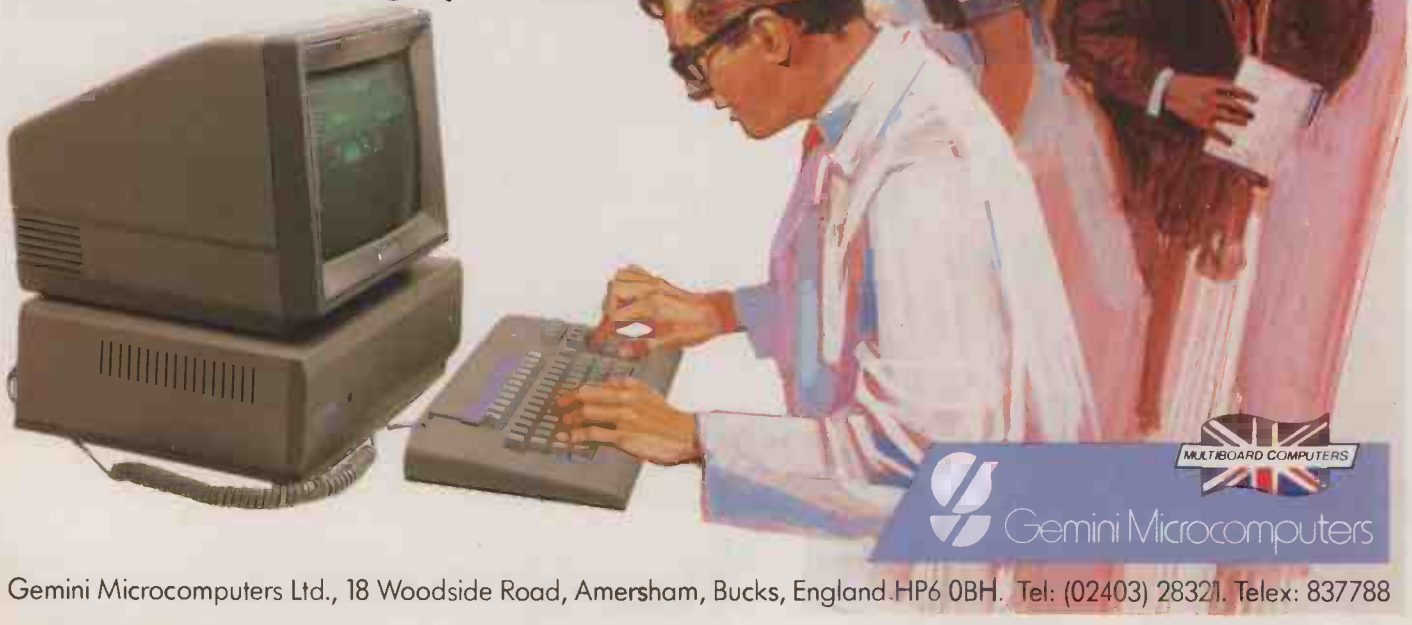

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Rising pitch

TWO ILLUSIONS, one visual and one audible, are combined in James Allwright's cunning program. A man walks up a closed uphill staircase to the sound of notes which appear to be constantly rising in pitch.

The staircase was originally drawn by M C Escher. It is a three-dimensional projection drawing for which some parameters are:

D — distance of observer from screen
SF — scale factor
VY and SF — constants which can be chosen fairly arbitrarily
SS — step size
VX — constant which must be adjusted to make the illusion work.

The UD at line 180 is the delay time. If you cannot tell what is going on you may reduce this but the author suggests that you do so only as a last resort.

```
   10 REM
   20 REM   "Climbing  Man"
   30 REM
   40 REM   by James Allwright
   50 REM
   60 REM
   70 REM   With Acknowledgements to
   80 REM
   90 REM   The Royal Institution
  100 REM
  110 REM   Christmas Lectures for t
he
  120 REM
  130 REM   original demonstration.
  140 REM
  150 ON ERROR VDU4:ON ERROR OFF:END
  160 DIMMX(35),MY(35),MN(35)
  170 DISP=40:D=3000:SF=130:VX=D+6*S
F:VY=4000
  180 SS=VY*2*SF/(16*D+70*SF):UD=30
  190 VDU23,224,0,0,6,&F,&1F,&1F,&1F
,&C
  200 VDU23,225,4,&C,&1E,&3E,&7F,&DF
,&9F,&BF
  210 VDU23,226,&FF,&FE,&7E,&7E,&7E,
&F8,&F0,&E0
  220 VDU23,227,0,0,0,1,3,3,7,&F
  230 VDU23,228,&FF,&FF,&C1,&C0,&80,
0,0,0
  240 VDU23,229,0,&80,&80,&C0,&66,&3
E,&1C,&18
  250 VDU23,230,&E,&1C,&18,&30,&60,&
C0,&F0,&F0
  260 VDU23,231,&F8,&FC,&CE,&C7,&C3,
&C1,&C0,&C1
  270 VDU23,232,0,0,0,0,&80,&C0,&C0,
&C0
  280 VDU23,233,&C7,&CC,&CC,&CE,&C6,
&C0,&F0,&F0
  290 VDU23,234,0,0,0,&18,&3C,&7E,&3
C,&18
  300 VDU23,235,0,0,0,1,3,7,6,6
  310 VDU23,236,&7E,&FF,&FF,&FF,&7E,
&7E,&7E,&7E
  320 VDU23,237,0,0,0,&80,&C0,&E0,&6
0,&60
  330 VDU23,238,4,4,6,2,2,0,0,0
  340 VDU23,239,&7E,&7E,&7E,&7E,&7E,
&7E,&7E,&7E
  350 VDU23,241,&7E,&66,&66,&66,&66,
&C6,&C6,&66
  360 VDU23,242,6,6,6,6,6,6,6,6
  370 VDU23,243,&7E,&66,&66,&66,&66,
&63,&63,&66
  380 VDU23,244,&60,&60,&60,&60,&60,
&60,&60,&60
  390 VDU23,245,0,0,&60,&F0,&F8,&F8,
&F8,&30
  400 VDU23,246,&20,&30,&78,&7C,&FE,
&FB,&F9,&FD
  410 VDU23,247,&FF,&7F,&7E,&7E,&7E,
&1F,&F,7
  420 VDU23,248,0,0,0,&80,&C0,&C0,&E
0,&F0
  430 VDU23,249,&FF,&FF,&83,3,1,0,0,
0
  440 VDU23,250,0,1,1,3,&66,&7C,&38,
&18
  450 VDU23,251,&70,&38,&18,&C,6,3,&
F,&F
  460 VDU23,252,&1F,&3F,&77,&E3,&C3,
&83,3,&83
  470 VDU23,253,0,0,0,0,1,3,3,3
  480 VDU23,254,&E3,&33,&33,&73,&63,
3,&F,&F
  490 MODE1
  500 MOVEDISP,0:DRAWDISP,DISP
  510 PROCMV(SF,0,5*SF):PROCMV(SF,0,
SF)
  520 PLOT85,FNX(SF,5*SF),FNY(0,SF)
  530 MOVEFNX(6*SF,4*SF),0:MOVEFNX(6
*SF,0),0
  540 PROCTRI(6*SF,8*SS,4*SF):PROCTR
I(6*SF,8*SS,0)
  550 X=5*SF
  560 FORA=0TO2:Z=A*SF:Y=(5+A)*SS
  570 PROCQUAD(X,Y,Z,X+SF,Y,Z,X+SF,Y
,Z+SF,0)
  580 PROCQUAD(X,Y,Z+SF,X+SF,Y,Z+SF,
X+SF,Y+SS,Z+SF,0)
  590 NEXT

  600 Z=3*SF
  610 FORA=0TO2:X=(5-A)*SF:Y=(8+A)*S
S
  620 PROCQUAD(X,Y,Z,X+SF,Y,Z,X+SF,Y
,Z+SF,0)
  630 PROCQUAD(X,Y,Z,X,Y,Z+SF,X,Y+SS
,Z+SF,3)
  640 NEXT
  650 X=0
  660 FORA=5TO1STEP-1:Y=-A*SS:Z=A*SF
  670 PROCQUAD(X,Y,Z,X+SF,Y,Z,X+SF,Y
,Z+SF,0)
  680 IFA<>5 PROCMV(X+SF,Y,Z):PROCMV
(X+SF,Y,Z+SF):PROCTRI(X+SF,Y-SS,Z+SF
)
  690 NEXT
  700 Z=0
  710 FORA=0TO5:X=SF*A:Y=A*SS
  720 PROCQUAD(X,Y,Z,X+SF,Y,Z,X+SF,Y
,Z+SF,0)
  730 IFA<>5PROCMV(X+SF,Y+SS,Z):PROC
MV(X+SF,Y,Z):GCOL0,0:PROCTRI(X+2*SF,
Y+SS,Z):GCOL0,3:PROCMV(X+SF,Y+SS,Z):
PROCDW(X+SF,Y,Z)
  740 NEXT
  750 FORA=0TO10:MN(A)=A MOD2
  760 MX(A)=FNX((A DIV2+0.5)*SF,SF/2
)
  770 MY(A)=FNY((A DIV2)*SS,SF/2)
  780 NEXT
  790 FORA=11TO17:MN(A)=2+A MOD2
  800 MX(A)=FNX(5.5*SF,SF*(A-10)/2)
  810 MY(A)=FNY(((A-1)DIV2)*SS,SF*(A
-10)/2)
  820 NEXT
  830 FORA=18TO24:MN(A)=4+A MOD2
  840 MX(A)=FNX((29-A)DIV2*SF+SF/2,3
.5*SF)
  850 MY(A)=FNY(((A-2)DIV2)*SS,3.5*S
F)
  860 NEXT
  870 FORA=25TO35:MN(A)=2+A MOD2
  880 MX(A)=FNX(SF/2,((35-A)/2)*SF+S
F/2)
  890 MY(A)=FNY(-((35-A)DIV2)*SS,((3
5-A)/2)*SF+SF/2)
  900 NEXT
  910 GCOL3,1:VDU19,1,2,0,0,0:VDU19,
2,2,0,0,0:VDU5
  920 A%=0:N%=0
  930 REPEAT
  940 PROCMAN(MN(A%),MX(A%),MY(A%))
  950 IF(A%MOD2)<>0SOUND0,0,0,UD/2:G
OTO1000
  960 SOUND&300,0,0,UD/2:N%=(N%+1)MO
D36
  970 SOUND&301,INT(ABS(18-N%)*5/6)-
15,53+4*N%,UD
  980 T%=(N%+12)MOD36:SOUND&302,INT(
ABS(18-T%)*5/6)-15,53+4*T%,UD
  990 T%=(N%+24)MOD36:SOUND&303,INT(
ABS(18-T%)*5/6)-15,53+4*T%,UD
 1000 PROCMAN(MN(A%),MX(A%),MY(A%)):
A%=(A%+1)MOD36
 1010 UNTIL0
 1020 END
 1030 DEFPROCQUAD(X1,Y1,Z1,X2,Y2,Z2,
X3,Y3,Z3,C)
 1040 X4=X1+X2-X3:Y4=Y1+Y3-Y2:Z4=Z1+
Z3-Z2
 1050 GCOL0,C
 1060 PROCMV(X2,Y2,Z2):PROCMV(X1,Y1,
Z1)
 1070 PROCTRI(X3,Y3,Z3):PROCTRI(X4,Y
4,Z4)
 1080 GCOL0,3-C
 1090 PROCMV(X1,Y1,Z1):PROCDW(X2,Y2,
Z2)
 1100 PROCDW(X3,Y3,Z3):PROCDW(X4,Y4,
Z4)
 1110 PROCDW(X1,Y1,Z1)
 1120 ENDPROC
 1130 DEFPROCMV(X,Y,Z):MOVEFNX(X,Z),
FNY(Y,Z)
 1140 ENDPROC
 1150 DEFPROCDW(X,Y,Z):DRAWFNX(X,Z),
FNY(Y,Z)
 1160 ENDPROC
 1170 DEFPROCTRI(X,Y,Z):PLOT85,FNX(X
,Z),FNY(Y,Z)
 1180 ENDPROC
 1190 DEFFNX(X,Z)=DISP+VX+D*(X-VX)/(
D+Z)
 1200 DEFFNY(Y,Z)=DISP+VY+D*(Y-VY)/(
D+Z)
 1210 DEFPROCMAN(A,X,Y)
 1220 ON A+1 GOSUB1240,1270,1300,133
0,1360,1390
 1230 ENDPROC
```

```
 1240 MOVEX,Y+5*32
 1250 VDU224,10,8,225,8,10,226,8,10,
231,232,8,8,10,233
 1260 RETURN
 1270 MOVEX+4,Y+5*32
 1280 VDU9,224,10,8,225,8,10,226,8,8
,10,227,228,229,8,8,8,10,230
 1290 RETURN
 1300 MOVEX-4*4,Y+5*32
 1310 VDU234,10,8,8,235,236,237,8,8,
8,10,238,239,240,8,8,10,241,8,10,242
 1320 RETURN
 1330 MOVEX-7*4,Y+5*32
 1340 VDU234,10,8,8,235,236,237,8,8,
8,10,238,239,240,8,8,10,243,8,10,244
 1350 RETURN
 1360 MOVEX,Y+5*32
 1370 VDU245,10,8,246,10,8,247,10,8,
8,253,252,8,10,254
 1380 RETURN
 1390 MOVEX-9*4,Y+5*32
 1400 VDU245,10,8,246,10,8,247,10,8,
8,250,249,248,10,8,251
 1410 RETURN
```

Normal probabilities.

```
   10 REM NORMAL DISTRIBUTION PROGRA
M
   20 REM COPYRIGHT (c)C DUNNE 1984
   30 REM VERSION 1.12 - REQUIRES OS
 1.2
   40 *FX16
   50 REM GIVES 1.25% SPEED INCREASE
 ON           A MODEL B MACHINE
   60 ONERRORREPORT:PRINT:VDU7:IFERR
<>17RUN ELSEEND
   70 DIMB$(4):B$(0)="from -"+CHR$22
7+CHR$228+" to  x":B$(1)="from -x  t
o  x":B$(2)="from  0  to  x":B$(3)="
from  x  to +"+CHR$227+CHR$228:B$(4)
="from  x  to y"
   80 *TV255,1
   90 MODE1
  100 *FX9,2
  110 *FX10,2
  120 VDU19,1,9,0,0,0,23,224,&1E,&30
,&30,&7C,&60,&60,&3C,0,23,225,3,3,6,
6,&6C,&3C,&18,0,23,226,&70,&3E,&37,&
36,&36,&36,&63,0,23,227,0,0,&1E,&33,
&33,&33,&1E,0,23,228,0,0,&F0,&98,&98
,&98,&F0,0
  130 CLS:COLOUR1:PRINTTAB(5)"C.D. N
ORMAL DISTRIBUTION V1.12"':COLOUR3
  140 INPUT"DO YOU REQUIRE INSTRUCTI
ONS (Y/N)",A$
  150 ONINSTR("YNyn",A$)GOTO160,170,
160,170ELSE140
  160 PROCinstruct
  170 VDU26,19,1,2;0;19,2,4;0;19,3,6
;0;
  180 x=FNget("x")
  190 CLS:PRINTTAB(18)"MENU:"'
  200 FORA%=0TO4
  210 PRINT';" ";A%+1;" : Evaluate P
 ";B$(A%)
  220 NEXT
  230 PRINT''''"Select:";
  240 G%=GET-48:IFG%<1ORG%>5THEN240
  250 y=-3:xP=x
  260 IFG%=1:y=x:x=-3
  270 IFG%=2:y=x:x=-x
  280 IFG%=3:y=x:x=0
  290 IFG%=4:y=3
  300 IFG%=5:y=FNget("y")
  310 Ax=x:IFABSAx>2.85:Ax=2.85*SGNA
x
  320 Ay=y:IFABSAy>2.85:Ay=2.85*SGNA
y
  330 CLS:PROCnormalgraph
  340 VDU28,0,31,39,19:PRINT"Z(x) pl
otted against x for |x|< 4":VDU28,0,
31,39,21
  350 PRINT"Evaluating the shaded (b
lue) area:"
  360 PROCfill_area(Ax,Ay)
  370 VDU28,0,31,39,23
  380 x=xP
  390 PRINT"x=";x,"","Z(x)=";FNZ(x)
  400 IFG%=5PRINT"y=";y,"","Z(y)=";F
NZ(y)'ELSEPRINT
  410 PRINT"P(x)=";
  420 IFG%=1 P=1-FNQ(x)
  430 IFG%=2 P=1-2*FNQ(x)
  440 IFG%=3 P=1/2-FNQ(x)
  450 IFG%=4 P=FNQ(x)
  460 IFG%=5 P=FNQ(x)-FNQ(y)
  470 PRINT;ABSP;"   ";B$(G%-1)
  480 COLOUR1:PRINT''''"Press any key
";:COLOUR3
  490 *FX15,1
  500 A%=GET
  510 GOTO170
  520 DEFPROCnormalgraph
  530 MOVE0,500:DRAW1279,500
  540 FORA%=16OTO1279STEP160:MOVEA%,
500:DRAWA%,480:VDU5:MOVEA%-16+16*((A
%/160-4)<0),472:PRINT;A%/160-4:VDU4:
NEXT
  550 FORA%=0TO1279STEP16
  560 X=(A%-640)/160
  570 Z=FNZ(X)
  580 B%=500+Z*1200
  590 IFA%=0 MOVEA%,B% ELSEDRAWA%,B%
  600 NEXT
  610 ENDPROC
  620 DEFPROCfill_area(x,y)
  630 GCOL0,2
  640 MOVE640+x*160,504:DRAW640+x*16
0SCLIOSCLI496+1200*FNZ(x)
  650 MOVE640+y*160,504:DRAW640+y*16
0,496+1200*FNZ(y)
  660 IFx=y THEN680
  670 IFx<y PROCFILL(644+x*160,504,2
) ELSEPROCFILL(636+x*160,504,2)
  680 GCOL0,3:MOVE640,500:PLOT21,640
,1023
  690 ENDPROC
  700 DEFFNQ(X)
  710 IFX<0 =1-FNQ(-X)
  720 LOCAL F,T
  730 T=1/(1+.2316419*X)
  740 F=.31938153*T-.356563782*T^2+1
.781477937*T^3-1.821255978*T^4+1.330
274429*T^5
  750 =ABS(FNZ(X)*F)
  760 DEFFNZ(X)=EXP(-X*X/2)/SQR(2*PI
)
  770 DEFPROChow_its_done
  780 CLS:PRINT"P(x) is calculated a
s follows:"'
  790 COLOUR2:PRINTTAB(7)"P(x)=1-Q(x
)   where"''TAB(17)"2    3    4    5
"'"Q(x)=Z(x)(b t+b t +b t +b t +b t
)+(x)"'TAB(11)"1   2    3    4    5
"'
  800 PRINTTAB(24)"2"'TAB(7)"Z(x)=1/
";CHR$129;"2";CHR$130;" exp(-x /2)"'
  810 PRINT"b =0.31938153"TAB(24)"b
=-0.356563782"'" 1"TAB(25)"2"''"b =1
.781477937"TAB(24)"b =-1.821255978"'
" 3"TAB(25)"4"''"b =1.330274429"'" 5
"'
  820 PRINT"t=1/(1+px)   where p=0.2
316419"':COLOUR3:PRINT"The absolute
error,":COLOUR2:PRINTTAB(26)"-8"'TAB
(12)"|";CHR$128;"(x)|< 7.5x10"':COLO
UR1
  830 PRINT'" Reference: ";:COLOUR3
:PRINT"Handbook of Mathematical"'"
Functions, Abramowitz and Stegun,"'"
 National Bureau of Standards, 1964
."'
  840 COLOUR2:PRINT"Press any key";:
COLOUR3
  850 A%=GET
  860 ENDPROC
  870 DEFPROCinstruct
  880 CLS:PRINT"   This program will
 enable you to"'"calculate values of
 Z(x) and P(x) for"'"any x."
  890 PRINT'"   When prompted 'x:',
do one of two"'"things. Either:"'"(
a) enter a value for x, or"'"(b) ju
st hit 'RETURN'."
  900 PRINT'"   In case (b), the pro
gram will ask"'"for values of m, mba
r and sigma, and"'"will then evaluat
e the expression:"':COLOUR2:PRINTTAB
(10)"x=(m - mbar)/sigma":COLOUR3:PRI
NT'"i.e. it will save you having to
work"
  910 PRINT"out x for yourself (lazy
!)."
  920 PRINT'"   Once the program has
 got x, you can"'"get Z(x) or P(x).
The limits for Z over"'"which P is e
valuated may be chosen from"'"the 'M
ENU' you will be offered."
  930 PRINT'"At any time, press 'ESC
APE' to abort."
  940 PRINT'"   Do you want to see t
he clever way"'"P(x) is evaluated? I
f so, type 'H' (for"'"Help), otherwi
se hit 'RETURN'."'
  950 INPUT":"A$
  960 IFA$="H"ORA$="h" PROChow_its_d
one
  970 ENDPROC
  980 DEFFNget(A$)
  990 LOCAL x
 1000 CLS:PRINTA$;
 1010 INPUT":"B$
 1020 IFB$=""THEN1030 ELSE=EVAL(B$)
 1030 INPUT'"     m :"m
 1040 INPUT"  mbar :"mbar
 1050 INPUT" sigma :"sigma
 1060 x=(m-mbar)/sigma
 1070 PRINT'''A$;"=";x''
 1080 INPUT"OK",B$
 1090 ONINSTR("YNyn",B$)GOTO1100,103
0,1100,1030ELSE1080
```

(continued on next page)

Normal probabilities

Probabilities and confidence limits based on a normal distribution are calculated by C Dunne. The results are plotted graphically to help eliminate operator error. The block-fill routine included in the source may be extracted and used elsewhere. The program runs on a menu and contains copious instructions — you can leave most of them out if you don't fancy typing it all in.

(continued from previous page)

```
 1100 =x
 1110 DEFPROCFILL(X,Y,C) LOCALV:DIMP
ARAM 7:A%=135:V=((USR(&FFF4)DIV&1000
0)AND15)-1:IFV=7ORV=6ORV=3 ENDPROC
 1120 W=2^(V MOD3+1):Z=2*W:V=POINT(X
,Y):IFC=V:ENDPROC ELSEGCOL0,C:GCOL0,
V+128
 1130 PROCUD(X,Y,4):PROCUD(X,Y,-4):E
NDPROC
 1140 DEFPROCUD(X,Y,S) LOCALF%,B%,C%
,D%,E%:PLOT76,X,Y:B%=FNC(4):C%=FNC(0
)
 1150 PLOT77,X,Y
 1160 Y=Y+S:D%=FNC(4):E%=FNC(0):IFE%
-C%<Z THEN1200
 1170 F%=C%
 1180 F%=F%+W:IFPOINT(F%,Y-S)=V PROC
UD(F%,Y-S,S)
 1190 IFF%<E%THEN1180
 1200 IFB%-D%<Z THEN1250
 1210 F%=D%
 1220 F%=F%+W
 1230 IFPOINT(F%,Y-S)=V PROCUD(F%,Y-
S,S)
 1240 IFF%<B%THEN1220
 1250 IFC%-E%<Z THEN1290
 1260 F%=E%
 1270 F%=F%+W:IFPOINT(F%,Y-2*S)=V PR
OCUD(F%,Y-2*S,-S)
 1280 IFF%<C%THEN1270
 1290 IFD%-B%<Z THEN1330
 1300 F%=B%
 1310 F%=F%+W:IFPOINT(F%,Y-2*S)=V PR
OCUD(F%,Y-2*S,-S)
 1320 IFF%<D%THEN1310
 1330 B%=D%:C%=E%:IFPOINT(X,Y)=V THE
N1150
 1340 IFPOINT(X,Y)=-1ENDPROC
 1350 F%=E%:REPEAT:F%=F%+W:UNTILF%>D
%ORPOINT(F%,Y)=V:IFF%>D%ENDPROC
 1360 X=F%:GOTO1150
 1370 DEFFNC(Z%):A%=13:X%=PARAM MOD2
56:Y%=PARAM DIV256:CALL&FFF1:=(PARAM
!Z%)AND&FFFF
```

Engineering notation.

```
   10 REM PenGDB    des fisher harlo
w(0279) 22450  1983
   20
   30 REM Demonstrates PROCenG
   40
   50  MODE 7
   60  PRINT'''"PenGDB";TAB(23);"des
fisher   1983"
   70  PRINT'"This program demonstra
tes PROCenG. It"
   80  PRINT"converts its argument,
num, into"
   90  PRINT"engineering notation."
  100  PRINT'"Engineering notation i
s when the"
  110  PRINT"exponent is always a mu
ltiple of three."
  120  PRINT'"PROCenG returns the st
ring n$ which"
  130  PRINT"has a maximum length se
t by field%."'
  140
  150  REPEAT
  160    INPUT'"Input your value",x

  170    PROCenG(x)
  180    PRINT'"In engineering notat
ion ";x;" ="
  190    PRINT'TAB((40-LEN(n$))/2);n
$
  200  UNTIL FALSE
  210
  220
  230 REM Converts num to n$ in engi
neering notation
  240 REM exponential power availabl
e as exp%
  250 REM mantissa available as l$
  260  DEF PROCenG(num)
  270   LOCAL field%,n,An,Ln
  280   field%=7:REM Max display cha
racters
  290    exp%=0:l$=""
  300    n=ABS(num):An=n
  310    IF n=0 THEN n$="0":ENDPROC
  320      Ln=LOG(n)
  330      exp%=INT(LOG(n)/3)*3
  340      n=num/(10^exp%)
  350      n$="E"+STR$(exp%)
  360      IF An<1E3 AND An>=1 THEN n
$=""
  370      field%=field%-LEN(n$)
  380      IF field%<LEN(STR$(INT(n))
) THEN PRINT"Field too small":ENDPRO
C
  390        l$=LEFT$(STR$(n),field%)
  400        IF RIGHT$(l$,1)="." THEN
l$=LEFT$(l$,LEN(l$)-1)
  410        n$=l$+n$
  420  ENDPROC
```

Engineering notation

Des Fisher's little routine, ProcEng, takes any number and generates a string which expresses it in engineering notation

Engineers who regularly have to deal with very large and very small numbers use a system similar to the exponential convention used in Basic. The difference is that engineers find it convenient to round the exponent — the part that represents the number of powers of 10 — to a multiple of three. So Basic's 15E2 becomes 1.5E3 or 1.5×10^3.

Though any number can be sent to ProcEng, the variable Field % can be used to set the maximum character count in n$. Inevitably there is some loss of accuracy when some significant figures are lost.

Snow scene.

```
   10  *TV 0,1
   20  MODE 2
   30  VDU 5
   40  FOR C%=8 TO 11:VDU 19,C%,4,0,
0,0:NEXT C%
   50  FOR C%=12 TO 15:VDU 19,C%,2,0
,0,0:NEXT C%
   60  C%=11
   70  FOR I%=0 TO 640 STEP 16
   80  J%=608+I%/4
   90  PROCskyhill(4,608+I%/4,1023,1
023,4,8)
  100  NEXT I%
  110  C%=12
  120  FOR I%=640 TO 1279 STEP 16
  130  J%=936-I%/4
  140  PROCskyhill(4,936-I%/4,1023,1
023,4,8)
  150  NEXT I%
  160  C%=16
  170  FOR I%=0 TO 640 STEP 16
  180  J%=0
  190  PROCskyhill(2,0,608+I%/4-52,6
08+(I%+8)/4,4,12)
  200  NEXT I%
  210  C%=16
  220  FOR I%=656 TO 1280 STEP 16
  230  J%=0
  240  PROCskyhill(2,0,936-I%/4-52,9
36-I%/4,4,12)
  250  NEXT I%
  260  T=30:H=120
  270  FOR N=1 TO 30
  280  GCOL 0,1
  290  X=RND(1200):Y=RND(608)
  300  MOVE X,Y:DRAW X+T,Y+H
  310  PLOT 85,X+2*T,Y
  320  NEXT N
  330  C%=8:B%=11:V%=700:W%=640
  340  REPEAT
  350  VDU 19,C%,4,0,0,0
  360  C%=C%+1+4*(C%=11)
  370  VDU 19,C%,7,0,0,0
  380  A=INKEY(5)
  390  VDU 19,B%,2,0,0,0
  400  B%=B%+1+4*(B%=15)
  410  VDU 19,B%,7,0,0,0
  420  A=INKEY(5)
  430  X%=RND(1279)
  440  REPEAT
  450  Y%=RND(936)
  460  UNTIL POINT(X%,Y%)<4 OR POINT
(X%,Y%)=7
  470  GCOL 0,7:PLOT 69,X%,Y%
  480  UNTIL FALSE
  490  DEF PROCskyhill(D%,E%,F%,G%,U
%,V%)
  500  REPEAT
  510  MOVE I%,J%
  520  GCOL 0,D%
  530  R%=RND(12)
  540  DRAW I%,J%+R%*4
  550  C%=C%-1-U%*(C%=V%)
  560  GCOL 0,C%
  570 PLOT 69,I%,J%+R%*4+4
  580  J%=J%+R%*4+8
  590  UNTIL J%>=F%
  600  GCOL 0,D%
  610  IF D%=2 DRAW I%,G%
  620  MOVE I%+8,E%:DRAW I%+8,G%
  630  ENDPROC
```

Snow scene

A wintry graphics demonstration program comes from P A Watmough. The snowflake effect is achieved by redefining four of the flashing colours to be blue and the other four to be green. The blue ones are then embedded in the sky and the green ones in the hill.

To give the impression of snow falling, the embedded spots are redefined to white for a moment, then returned to the background colour. If this is done in an ordered sequence, the impression of moving down can be obtained. PC

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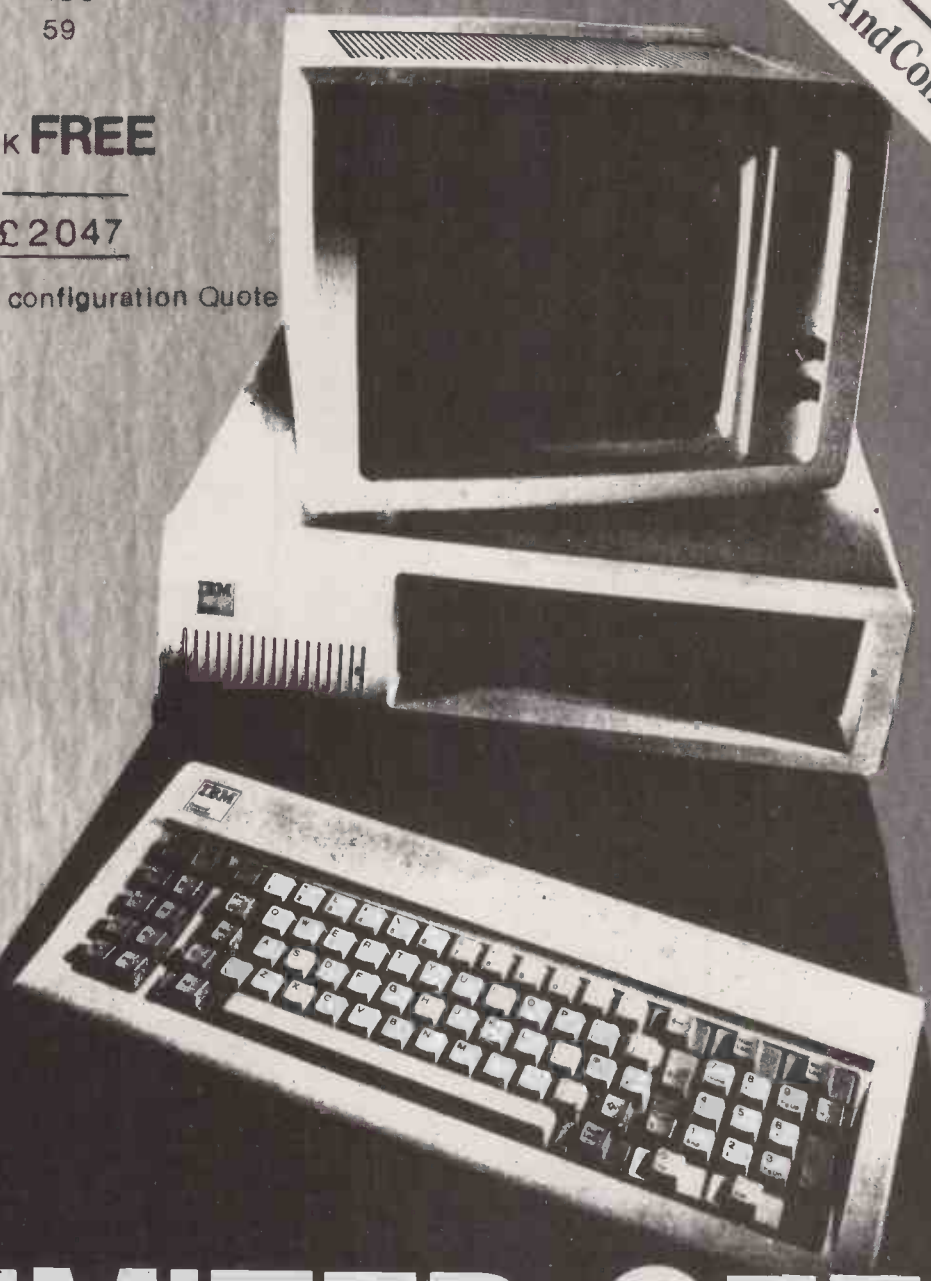

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Date checker

MANY PROGRAMS invite the user to enter the date, and so require a validation test to check that they are legal. Many programmers will have a stock routine that does this, but it can be a tricky thing to write, and if not done economically takes up valuable program space.

James Garlick has provided a date-checking routine which is not easy to follow but only requires a single line of code. In the accompanying example, which I have constructed to show the routine in action, it is in line 100.

James Garlick splits the input into three variables D, M and Y. M is easy to test as it must be greater than 0 but less than 13. Tests of D are usually cumbersome, he says, because of the apparently haphazard relationship between the number of the month and the number of days in it.

His solution is to construct a table. The first row, M, is the month number. The second row is produced by Anding M with 1, to obtain 1 when M is odd, and 0 otherwise. The third row, N, has 1 if there are 31 days in the month, and 0 otherwise.

The essence of the problem is then to derive N from M, which can be done by the relation

N = (M + (M > 7))AND1

For January to July, months 1 to 6, M > 7 is false and has the value 0. For August onwards it is true and has the value −1; this is used to switch M from even to odd. The routine therefore checks that D is less than 31 + N, with a further subtraction for the second month, February.

Note the use of

(Y AND 3) = 0

as a simple test of divisibility when the denominator is a pure power of two. Also note that the whole test assumes a Basic in which True has a value of −1. If you are converting for a Basic where True generates 1, the signs in front of

M = 2

and

(Y AND 3)

must be changed

The test will be correct for the year 2000, which will be a leap year. It will fail for 2100, but James Garlick adds "any complaints at that time should be sent to the writer by air mail".

M	1	2	3	4	5	6	7	8	9	10	11	12
M And 1	1	0	1	0	1	0	1	0	1	0	1	0
N	1	0	1	0	1	0	1	1	0	1	0	1

Date checker.

```
10 PRINT "DATE:";:INPUT D
20 PRINT "MONTH:";:INPUT M
30 PRINT "YEAR:";:INPUT Y
100 K=D*M*(M<13)*(D<31+((M+(M*7))AND 1)+(M=2)*(2+((Y AND 3)=0)))
120 IF K=0 THEN PRINT "THE DATE IS ILLEGAL"
130 GOTO 10
```

Function-key control

When using Basic on the IBM PC, the system provides a useful set of definitions for the function keys along the bottom of the screen. You can get rid of these by typing Key Off, or including it in a program, but this only removes them from the screen. If the user actually presses any of the function keys they still work, and this can be a problem.

Mike Curtis has provided a very small routine which clears the keys until Basic or Basica is reloaded — see lines 10 to 50 in the accompanying listing. The routine Peeks the memory addresses where the function keys are located and stores them in the array Mem( ). This could be done by including these lines at the start of your program. Then, at the end of your program, use lines 9000 to 9020 to restore the values obtained in lines 20 to 50 and so reactivate the keys.

I have added five lines to Mike Curtis's listing to show how the idea works in practice. The screen is cleared while the Test routine in line 110 is run, then the program stops. To continue and restore the keys to their original functions, type Cont.

Function-key control.

```
10 DIM MEM(160)                          'Define array
20 FOR I=1619 TO 1778                    'Store chars
30 MEM(I-1618)=PEEK(I)                   'into array
40 POKE I,0                              'clear char
50 NEXT I
100 KEY OFF
110 FOR TEST=1 TO 20:PRINT "PC Rules OK":NEXT
120 KEY OFF:STOP
9000 FOR I=1619 TO 1778                  'Redefine keys
9010 POKE I,MEM(I-1618)                  'once again
9020 NEXT I
9030 KEY ON
9040 PRINT "Done"
```

Printing with WordStar

The current versions of WordStar do not support the double-width and compressed-print facilities available on the IBM PC Graphics Printer. However, it is possible to access these using the User Printer Controls decribed on page 7.3 of the WordStar manual. To use them you have to set up a patch so they become operative, and to do that you need to use Debug, IBM's answer to DDT.

Firstly, load the DOS disc into drive A and a copy of the WordStar system disc into drive B. Do not use the master copy supplied by Micropro. Type

DEBUG B:WS.COM

to load Debug and then WS.COM. The part that needs to be patched starts at 077F, and the relevant code is given on

(continued on next page)

(continued from previous page)

page 6 of User 4, Printer Patch area in appendix C of the WordStar Manual.

A screen prompt of

—

will be seen, indicating that Debug is ready for its next command. So type

D 0770

to Dump the section of WordStar you are interested in. The screen will display a block of hexadecimal numbers with the boundary address on the left and an ASCII portion on the right, as shown in figure 1.

You now need to enter the appropriate ASCII printer codes which control the turning on and off of the compressed and extended print modes. From the printer handbook these are found to be: Compressed mode On, 15; Compressed mode Off, 18; Extended mode On, 14; Extended mode Off, 20. The equivalent hex values, which are the ones you need to insert are 0F, 12, 0E and 14. You need to enter them into the correct locations, preceding each one by a single byte to tell WordStar how many bytes are in the following command. Since each of the commands is one byte long the flag byte is 01.

Accordingly, enter the following information into these locations

```
077F    01
0780    0F
0784    01
0785    12
0789    01
078A    0E
078E    01
078F    14
```

By typing E followed by the address the current contents of that location are displayed. The new contents are then entered. If required, the Enter key can be pressed after each entry.

An easier method is to press the space bar after an entry has been made. This advances the pointer to the next location whose contents are shown, and the procedure is then repeated. The Enter key then only needs to be pressed when that batch is completed. This was how the entries shown in figure 2 were made.

When all this is completed Dump the relevant part of the file to check that the new commands have been inserted correctly. If all is well type W to Write the amended version back to the disc. Follow this by a Q to return to DOS.

The new facilities are invoked in the same way as the other printer control codes by typing Control-P followed by the relevant letter.

^P^Q turns compressed print on
^P^W turns it off
^P^E turns expanded print on
^P^R turns it off

The ^P^E command, unlike ^P^Q, is cancelled by a Carriage Return and has to be reinvoked at the beginning of the next line. You may also find on printing that additional spaces are inserted into the text and the spacing will then have to be adjusted within WordStar. With compressed print it is possible to get round this by putting the ^P^Q on a blank line before the part you want compressed.

Once you are sure it works then you can Copy the amended version of WS.Com on to your other WordStar system discs. For safety, leave the master untouched. PC

```
Example of compressed print on the IBM PC using Wordstar

Example of extended pr
```

WordStar printing.

Figure 1.

```
A>DEBUG B:WS.COM
-D 0770
0964:0770  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0964:0780  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0964:0790  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0964:07A0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0964:07B0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0964:07C0  00 2D 5F 90 90 C3 90 90-C3 00 00 00 90 90 90 BA   .-_..C..C......:
0964:07D0  00 00 B4 02 CD 17 80 E4-A0 75 01 F9 C3 90 90 90   ..4.M..d u.yC...
0964:07E0  90 90 90 90 90 BA 00 00-B4 00 CD 17 C3 90 F9 C3   .....:..4.M.C.yC
-
```

Figure 2.

```
-
-E 077F
0964:077F  00.01
0964:0780  00.0F
-E 0784
0964:0784  00.01    00.12
-E 0789
0964:0789  00.01    00.0E
-E 078E
0964:078E  00.01    00.14
-
-D 0770
0964:0770  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 01   ................
0964:0780  0F 00 00 00 01 12 00 00-00 01 0E 00 00 00 01 14   ................
0964:0790  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0964:07A0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0964:07B0  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0964:07C0  00 2D 5F 90 90 C3 90 90-C3 00 00 00 90 90 90 BA   .-_..C..C......:
0964:07D0  00 00 B4 02 CD 17 80 E4-A0 75 01 F9 C3 90 90 90   ..4.M..d u.yC...
0964:07E0  90 90 90 90 90 BA 00 00-B4 00 CD 17 C3 90 F9 C3   .....:..4.M.C.yC
-W
Writing 5180 bytes
-Q
```

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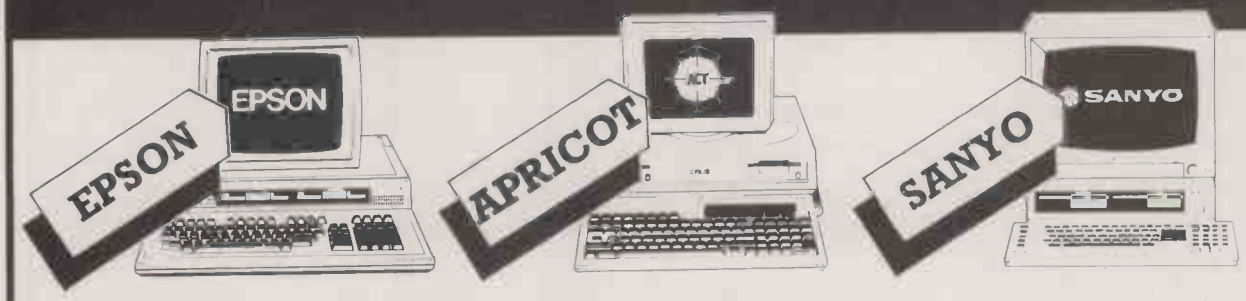

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Basic screen dump

BASIC is too slow to be of much use for dumping the contents of the Amstrad screen to a printer, but F M Collins has written a fast machine-code program to do the job. Intended for the Mannesmann Tally MT-80 printer it also works successfully with the Shinwa CPA-80, but for other Epson-type printers slight modifications may be required.

A Basic loading program and assembler listing are supplied. Several NOPs are included in the assember listing, both to serve as markers and to allow space for any additional control codes required.

The seven-line data bus of the 464's Centronics port has made life interesting and the 640-bit line length has had to be handled as 639 plus 1. Trying to divide the 400-line screen by 14 or 7 is not much easier, and this is taken as

$$28 \times 14 + 8$$

in the text mode and

$$57 \times 7 + 1$$

in graphics mode. The latter prints every bit of information twice, similar to the VDU display, and gives a more acceptable aspect ratio; it also takes twice as long.

Connect your printer, then enter and run the Basic loader. If you have entered the data correctly you will be prompted to enter G or T and the listing will reappear.

```
10 '       SCREEN DUMP LOADER  (c) F.M.Collins 1985
15 MEMORY 43708:MODE 2:tot=0
20 FOR j=43709 TO 43900:READ n$
25 n=VAL("&"+n$):tot=tot+n
30 POKE j,n:NEXT
35 IF tot<>23095 THEN PRINT "Checksum error - check data":LIST
40 DATA C5,E5,D5,F5,CD,2E,BD,DA,49,AB,CD,BA,BB,3E,01,32,7F,AB,21,90
45 DATA 01,22,7D,AB,CD,4E,AB,3E,2F,CD,1E,BB,20,6A,3E,0D,00,00,CD,2B
50 DATA BD,3E,0A,00,00,CD,2B,BD,3E,1B,CD,2B,BD,3E,41,00,00,CD,2B,BD
55 DATA 3E,07,CD,2B,BD,3E,1B,CD,2B,BD,3E,4B,00,00,CD,2B,BD,3E,7F,CD
60 DATA 2B,BD,3E,02,CD,2B,BD,11,00,00,CD,56,AB,13,7A,FE,02,20,F7,7B
65 DATA FE,7F,20,F2,3E,1B,CD,2B,BD,3E,4B,00,00,CD,2B,BD,3E,01,CD,2B
70 DATA BD,3E,00,CD,2B,BD,E5,CD,56,AB,E1,3E,07,32,7F,AB,7D,B4,20,89
75 DATA F1,D1,E1,C1,C9,F5,CD,2E,BD,38,FB,F1,C9,D5,01,00,00,2A,7D,AB
80 DATA 3A,7F,AB,E5,F5,C5,CD,F0,BB,C1,CB,10,80,47,F1,E1,2B,00,D1,D5
85 DATA 3D,20,EC,78,CD,4E,AB,CD,2B,BD,D1,C9
90 PRINT "Program now loaded. Press G for graphics mode or T for text mode."
95 a$=INKEY$:IF a$="" THEN 95
100 IF a$="T" OR a$="t" THEN POKE &AACB,4:POKE &AB6E,43:GOTO 115
105 IF a$="G" OR a$="g" THEN POKE &AACB,1:POKE &AB6E,0:GOTO 115
110 GOTO 95
115 PRINT a$;" Mode.  Hold down Space-bar to stop dump -":LIST
```

Enter Call 43709 as a direct command and the screen will be dumped to the printer. If the printer is not connected and switched on, the Call will return directly to the Basic. Immediately before saving the program to tape, replace line 150 by

150 New

and the loader can then be used to enter the machine code into the CPC-464 and delete itself before you write your own Basic program.

This should use the command Call 43709 whenever a printout is required and it can switch between text and graphics modes by using the Pokes in lines 100 and 105 of the loader. Holding down the space bar will abort a dump and return control to Basic.

Make the first line of your program

10 MEMORY 43708: LOAD"!

and the last line line

60000 SAVE"YOURPROGRAM":
SAVE"!DUMP",B,43709,192

Goto 60000 will now save both the Basic and the machine code; reloading the program with Run" will load both. PC

```
AABD          10          ORG  43709
BD2B          20 PRINT:   EQU  £BD2B      ; "MC PRINT CHAR"
              30
AABD  C5      40          PUSH BC
AABE  E5      50          PUSH HL
AABF  D5      60          PUSH DE
AAC0  F5      70          PUSH AF         ; Save registers.
AAC1  CD2EBD  80          CALL £BD2E
AAC4  DA49AB  90          JP   C,HOME     ;Return if no printer.
AAC7  CDBABB 100          CALL £BBBA      ;Set user origin.
AACA  3E01   110          LD   A,1
AACC  327FAB 120          LD   (DOTS),A   ;Top row scan only.
AACF  219001 130          LD   HL,400
              140
AAD2  227DAB 150 ROW:     LD   (LINE),HL  ;Line count.
AAD5  CD4EAB 160          CALL WAIT       ;Wait if printer busy.
AAD8  3E2F   170          LD   A,47       ;SPACE-BAR -
AADA  CD1EBB 180          CALL £BB1E      ; if pressed -
AADD  206A   190          JR   NZ,HOME    ; return to BASIC.
AADF  3E0D   200          LD   A,13
AAE1  00     210          NOP
AAE2  00     220          NOP
AAE3  CD2BBD 230          CALL PRINT      ;Carriage return.
AAE6  3E0A   240          LD   A,10
AAE8  00     250          NOP
AAE9  00     260          NOP
AAEA  CD2BBD 270          CALL PRINT      ;Paper feed.
AAED  3E1B   280          LD   A,27
AAEF  CD2BBD 290          CALL PRINT
AAF2  3E41   300          LD   A,"A"
AAF4  00     310          NOP
AAF5  00     320          NOP
AAF6  CD2BBD 330          CALL PRINT
AAF9  3E07   340          LD   A,7
AAFB  CD2BBD 350          CALL PRINT      ;Line spacing to 7/32"
AAFE  3E1B   360          LD   A,27
AB00  CD2BBD 370          CALL PRINT
AB03  3E4B   380          LD   A,"K"
AB05  00     390          NOP
AB06  00     400          NOP
AB07  CD2BBD 410          CALL PRINT      ;Printer set to graphics
AB0A  3E7F   420          LD   A,127
AB0C  CD2BBD 430          CALL PRINT
AB0F  3E02   440          LD   A,2
AB11  CD2BBD 450          CALL PRINT      ; - for 639 bytes.
AB14  110000 460          LD   DE,0       ;  Byte counter.
AB17  CD56AB 470 BYTE:    CALL BITS       ;Read and print a byte,
AB1A  13     480          INC  DE
AB1B  7A     490          LD   A,D
AB1C  FE02   500          CP   2
AB1E  20F7   510          JR   NZ,BYTE
AB20  7B     520          LD   A,E
AB21  FE7F   530          CP   127
AB23  20F2   540          JR   NZ,BYTE    ;repeat for 639 bytes.
AB25  3E1B   550          LD   A,27
AB27  CD2BBD 560          CALL PRINT
AB2A  3E     570          LD   A,"K"
AB2C  00     580          NOP
AB2D  00     590          NOP
AB2E  CD2BBD 600          CALL PRINT      ;Reset printer to graphic
AB31  3E01   610          LD   A,1
AB33  CD2BBD 620          CALL PRINT
AB36  3E00   630          LD   A,0
AB38  CD2BBD 640          CALL PRINT      ; -  for one byte.
AB3B  E5     650          PUSH HL
AB3C  CD56AB 660          CALL BITS       ;Read and print last byte
AB3F  E1     670          POP  HL
AB40  3E07   680          LD   A,7
AB42  327FAB 690          LD   (DOTS),A   ;Reset scan to 7 bits.
AB45  7D     700          LD   A,L
AB46  B4     710          OR   H
AB47  2089   720          JR   NZ,ROW     ;Loop for 29/58 rows.
AB49  F1     730 HOME:    POP  AF
AB4A  D1     740          POP  DE
AB4B  E1     750          POP  HL
AB4C  C1     760          POP  BC         ;Restore registers
AB4D  C9     770          RET             ;and return to BASIC.
              780
AB4E         790 WAIT:
AB4E  F5     800          PUSH AF
AB4F  CD2EBD 810 BUSY:    CALL £BD2E      ;Test if printer busy
AB52  38FB   820          JR   C,BUSY     ;and loop till free.
AB54  F1     830          POP  AF
AB55  C9     840          RET
              850
AB56         860 BITS:
AB56  D5     870          PUSH DE
AB57  010000 880          LD   BC,0       ;B will hold byte.
AB5A  2A7DAB 890          LD   HL,(LINE)  ;Top line of row.
AB5D  3A7FAB 900          LD   A,(DOTS)   ; 1, 4 or 7.
AB60  E5     910 LOOP:    PUSH HL
AB61  F5     920          PUSH AF
AB62  C5     930          PUSH BC
AB63  CDF0BB 940          CALL £BBF0      ;"GRA TEST ABSOLUTE"
AB66  C1     950          POP  BC
AB67  CB10   960          RL   B          ;Multiply by 2 and
AB69  80     970          ADD  A,B        ;add bit (if any)
AB6A  47     980          LD   B,A        ;  into B.
AB6B  F1     990          POP  AF
AB6C  E1    1000          POP  HL
AB6D  2B    1010          DEC  HL         ;Step down 1
AB6E  00    1020          NOP             ;              or 2.
AB6F  D1    1030          POP  DE
AB70  D5    1040          PUSH DE
AB71  3D    1050          DEC  A
AB72  20EC  1060          JR   NZ,LOOP    ;Loop "DOTS" times.
AB74  78    1070          LD   A,B
AB75  CD4EAB1080          CALL WAIT
AB78  CD2BBD1090          CALL PRINT      ;Print byte.
AB7B  D1    1100          POP  DE
AB7C  C9    1110          RET             ;Return to ROW loop.
            1120
AB7D        1130 LINE:    DEFS 2          ; Line count.
AB7F        1140 DOTS:    DEFS 1          ;Height of row in bits.
```

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by Mike Todd

Saving and Loading

IT IS USEFUL to be able to save blocks of memory to disc or tape, and to load them back from within a program. This can be very difficult since Commodore machines reset many pointers when a Load has occurred and will also try to run the program in memory when the Load is completed.

The routines given are for the 64 and allow this to be performed much more easily. The first routine, at line 60000, saves a block of memory such as a high-resolution screen or block of machine code, where SA is the starting address and EA the end address plus 1.

The routine at line 60100 loads it back at an address specified by SA, which could be different from the address where the block was originally. If it is simply a matter of loading it back to the same locations that it originally occupied, then use the routine at line 60200.

The Sys commands in all three routines are in the same form as the normal Load and Save. These are shown for disc, device 8, but work equally well for the cassette by changing this to 1.

Memory save.

```
60000 REM ******* SAVE BLOCK OF MEMORY
60010 REM ******* FROM SA  TO  EA

60020 SH=INT(SA/256): SL=SA-SH*256
60030 EH=INT(EA/256): EL=EA-EH*256
60040 SYS(57812) "FILENAME",8
60050 POKE 780,2: POKE 2,SL: POKE 3,SH
60060 POKE 781,EL: POKE 782,EH
60070 SYS(65496)
60080 RETURN
```

Load to new address.

```
60100 REM ******* LOAD BLOCK OF MEMORY
60110 REM ******* STARTING AT SA

60120 SH=INT(SA/256): SL=SA-SH*256
60130 SYS(57812) "FILENAME",8
60140 POKE 781,SL: POKE 782,SH
60150 POKE 780,0
60160 SYS(65493)
60170 RETURN
```

Reload to original address.

```
60200 REM ******* LOAD BLOCK OF MEMORY
60210 REM ******* FROM WHENCE IT CAME

60220 SYS(57812) "FILENAME",8,1
60230 POKE 780,0
60240 SYS(65493)
60250 RETURN
```

High-resolution screen dump

The high-resolution graphics capabilities of both the Commodore 64 and the Epson MX and FX printers are well suited to each other — that is, as long as you have the software to take the high-resolution image in the 64 and convert it to the appropriate bit-image data.

This can be done very slowly in Basic, or much faster in machine code. This program is based on one from J R Jones and is a mixture of the two. It shows how machine code can be used to speed up the slower parts of Basic. The data format required by the printer is different to the 64's internal represention and the machine code in the program takes care of this conversion.

The printer is first set in line 1020 to a line spacing so that there are no gaps between the printed lines. Then all 25 lines of the screen, each containing eight high-resolution lines, are printed. Line 1035 sets the printer into bit-map mode, expecting 320 characters of data. The routine at 1040 sends eight characters of data at a time, sent by the machine code.

The machine code occupies the cassette buffer, but is fully relocatable and could be placed anywhere convenient simply by changing the value of S in line 1800.

The program assumes in lines 1015 that the high-resolution screen starts at 8192. This is alterable provided that the screen can be read and is not sitting underneath one of the ROMs.

High-resolution screen dump.

```
1000 REM **** MX80 SCREEN DUMP

1005 GOSUB 1800      :REM SET UP M.CODE

1010 OPEN 1,4
1015 SA=8192
1020 PRINT#1,CHR$(27);"A";CHR$(8);

1030 FOR Y=0 TO 24
1035  PRINT#1,CHR$(27);"K";CHR$(64);
     CHR$(1);

1040  FOR BY=0 TO 312 STEP 8
1050   SP=BY+320*Y+SA
1060   MS=INT(SP/256)
1070   LS=SP-MS*256
1080   POKE 150,LS: POKE 151,MS
1100    SYS S
1110   NEXT BY

1120   PRINT#1,CHR$(10)

1130 NEXT Y

1135 CLOSE 1
1140 END

1798 REM POKE IN MACHINE CODE ROUTINE

1800 S=832: C=0
1810 READ X
1820 IF X>255 THEN 1850
1830 POKE S,X: C=C+X: S=S+1: GOTO 1810
```

(continued on next page)

(continued from previous page)

```
1850 IF X<>C THEN PRINT"DATA ERROR":STOP
1860 RETURN

1999 REM DATA FOR MACHINE CODE
2010 DATA 165,150,133,97,165,151,133,98
2015 DATA 169,128,133,99,169,0,133,174
2020 DATA 169,128,133,175,160,0,177,150
2025 DATA 37,99,197,99,208,7,165,174
2030 DATA 24,101,175,133,174,70,175,166
2035 DATA 175,224,0,208,23,152,72,162
2040 DATA 1,32,201,255,165,174,32,210
2045 DATA 255,104,168,70,99,166,99,224
2050 DATA 0,208,16,96,165,150,24,105
2055 DATA 1,144,2,230,151,133,150,240
2060 DATA 195,208,193,165,97,133,150,165
2065 DATA 98,133,151,240,175,208,173
2070 DATA 12763
```

Reverse Rems and Relocator revisited

The Reverse Rems program in the November 1984 Commodore Open File prompted several readers to point out that it does not work on the Commodore 64 due to the use of locations 0 and 1.

There were other problems with this program and Mike Hart of Wigston in Leicestershire has produced a more robust version. It is listed as a Basic loader and as a disassembly, and is executed with Sys828 For Basic 2/4 Pets, change line 11 to

11 DATA 165,41

In the same issue, the Relocator also suffered problems and M E Funnell has offered a modified version. The major problem is that location $408F should have been $F0 and not $D0 — that is BEQ and not BNE. In addition, the revised version preserves locations $54 and $55 to avoid the need for additional Pokes.

Mr Funnell also points out that the program does not relocate itself as described, as it modifies its own internal addresses while executing. KO

Modified Relocator.

```
4000 AA AA AA AA AA AA AA AA
4008 AA AA AA AA A5 54 48 A5
4010 55 48 AD 08 40 38 ED 04
4018 40 8D 0A 40 AD 09 40 ED
4020 05 40 8D 0B 40 AD 00 40
4028 85 54 AD 01 40 85 55 A0
4030 00 B1 54 20 83 40 C9 03
4038 D0 2F C8 B1 54 CD 04 40
4040 C8 B1 54 ED 05 40 90 1F
4048 88 B1 54 CD 06 40 C8 B1
4050 54 ED 07 40 B0 11 88 B1
4058 54 18 6D 0A 40 91 54 C8
4060 B1 54 6D 0B 40 91 54 A9
4068 03 18 65 54 85 54 90 02
4070 E6 55 CD 02 40 A5 55 ED
4078 03 40 90 B3 68 85 55 68
4080 85 54 00 48 C9 20 F0 0C
4088 29 1F C9 19 F0 06 29 0C
4090 C9 0C D0 04 68 A9 03 60
4098 68 29 9F F0 06 29 0D 49
40A0 08 D0 03 A9 01 60 A9 02
40A8 60 AA AA AA AA AA AA AA
```

Reverse Rems.

```
1 REM *** DISTINCT-REMS  ***
2 REM *** BY M. C. HART  ***
3 :
4 FORJ=828 TO 882
5 READ A:POKEJ,A:C=C+A
6 NEXT
7 ;
8 READ K
9 IF K<>C THEN PRINT"DATA ERROR"
10 :
11 DATA 165.44
12 DATA 133,89.169.5.133.88
13 DATA 160,0,177,88,240,19,201,143
14 DATA 240,8,230,88,208,242,230,89
15 DATA 208,238,200,169,18,145,88,208
16 DATA 241,200,177,88,200,17,88,240
17 DATA 13,24,169,5,101,88,133,88
18 DATA 144,214,230,89,176,210,96
19 ;
20 DATA 7494
```

Disassembly.

```
033C A5 2C      LDA $2C
033E 85 59      STA $59
0340 A9 05      LDA #$05
0342 85 58      STA $58
0344 A0 00      LDY #$00
0346 B1 58      LDA ($58),Y
0348 F0 13      BEQ $035D
034A C9 8F      CMP #$8F
034C F0 08      BEQ $0356
034E E6 58      INC $58
0350 D0 F2      BNE $0344
0352 E6 59      INC $59
0354 D0 EE      BNE $0344
0356 C8         INY
0357 A9 12      LDA #$12
0359 91 58      STA ($58),Y
035B D0 F1      BNE $034E
035D C8         INY
035E B1 58      LDA ($58),Y
0360 C8         INY
0361 11 58      ORA ($58),Y
0363 F0 0D      BEQ $0372
0365 18         CLC
0366 A9 05      LDA #$05
0368 65 58      ADC $58
036A 85 58      STA $58
036C 90 D6      BCC $0344
036E E6 59      INC $59
0370 B0 D2      BCS $0344
0372 60         RTS
0373 00         BRK
```

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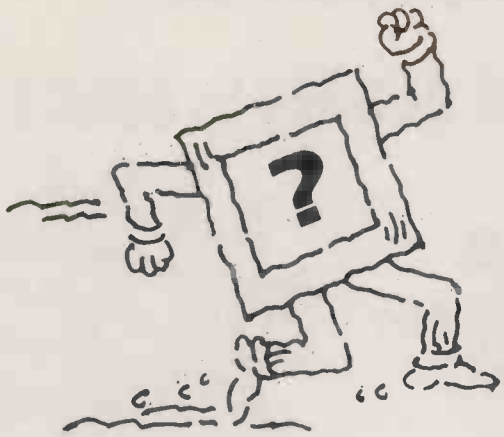

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Easy PC

A selection of reading matter for users of IBM's Personal Computer, plucked by Paul Myers from the deluge of titles.

THE BOOM MARKET of a year ago in computer books is having something of a shake-out. Retailers are returning up to 40 percent of the stocks supplied by some publishers, and Sybex is just one of several companies reportedly laying off staff. Look along the shelves of a computer bookshop and the reason is obvious. There is much duplication, and most of the material is quickly superseded by new technology and new fashion.

When the IBM PC was introduced, easy-to-understand guides to all aspects of its use were required, and the first to publish made profitable sales whatever the quality of the product. Now, two years and several hundred books later, even the most outstanding new guide to Basic programming will find little space on readers' bookshelves.

This is the dilemma for *IBM PC and XT Owner's Manual* by Chertok, Rosenfeld and Stone. It makes an adequate first practical guide for the naive new user but is redundant when you consider what is already available. M De Pace's *The IBM Personal Computer* suffers twice over — by not being first, and by being poorly organised and formatted. This book is not a practical guide, but provides a superficial taste of the usual microcomputer topics like software packages, languages, DOS and hardware.

On the other hand, *A Comprehensive Guide to the IBM Personal Computer* brings together information from IBM manuals and other sources more comprehensively than most. The 53-page "What to get" section covers the choice of hardware and accessories, and the different categories of software available. The 150 pages on operating the PC deal with everything from switching on to the detailed operation of IBM's interactive debugger. Basic seems an obligatory topic for books of this kind but Markowsky's 150 pages find room for esoteric hints like how to get round the bug in IBM's implementation of the Shell command. The curious PC user often ends up with a vague interest in assembler programming, so it is not inappropriate to finish with a 50-page introduction to the subject. The regular references to books and magazine articles and the apparent support given by IBM in its production makes this book one to recommend.

Simon Lucy's *MS-DOS User Book* provides a comprehensive and pleasantly concise guide to Microsoft's generic product. A reference book, it covers the commands, utilities, structure, interrupts and interfaces of version 1.25 of the operating system; it is unfortunate that it has largely been superseded by MS-DOS 2. *Programmer's Guide to MS-DOS for the IBM PC* is less comprehensive. This rather dull book sets out to provide "a full description of the programming interface to the MS-DOS functions". It does provide a reasonable source of information for DOS 2 function calls, each being discussed with a short program example. The book ends with a 40-page chapter that describes interrupts to the IBM PC BIOS.

Programming the IBM PC & XT: A Guide to Languages has the remarkable aim of teaching novice PC users to operate the machine and to program in Basic, Fortran, Cobol, Pascal, machine language and assembler. The regular review exercises, concise style and compact typesetting cannot make a success of this impossible task as there is far too much material to cover in one tutorial volume. Nevertheless it will stay on my shelves as a reference to languages I am less familiar with.

Volumes on Basic continue to pour forth. David Schneider's *Handbook of Basic for the IBM PC* is for those who find IBM's rather comprehensive manual not comprehensive enough. The book is organised alphabetically by command and gives plenty of detailed description as well as programming examples.

Fancy Programming in IBM PC Basic provides code for essential routines such as controlling numeric keyboard input, menu handling, aligning screen output, sorting and merging, handling linked lists, virtual arrays and the use of pointers. It is a great little book for those whose imagination and programming needs have raced ahead of their programming technique.

Those concerned with gathering the sort of data associated with market surveys and deriving descriptive statistics may find *IBM PC Statistics* of interest. It uses 60 pages of compact Basic code to expound the theory of hypothesis testing, correlation and regression, variance analysis, and other techniques. Children aged six to 12 with a desire to make the computer "do something" should enjoy the problems presented in *Computer Playground IBM PC,* which is formatted as a large colouring book. It presents short fun routines in Basic, and prompts inquiring minds by setting questions usually answered by a few lines of code.

IBM PC owners frustrated at seeing Basic programs published in this and other journals for Apple, Commodore, Atari and Tandy computers need suffer no more. Harris and Scofield have written *IBM PC Conversion Handbook of Basic,* which enables programs to be translated easily with reference to their instructions.

Graphics and games present an aspect of Basic that is well covered by different authors. Tony Fabbri's *Animation Games and Sound for the IBM PC* requires the minimum-configuration machine and no graphics. From simple shapes for cars and rockets, through making stick men walk or swim, the author leads up to a racetrack game wtih sound effects and the tune of *Yanky Doodle Dandy* to the accompaniment of an on-screen firework display.

J Edward Volkstorf in *Graphics Programming on the IBM Personal Computer* confines himself to Basic and consequently achieves greater clarity with sections on the Basic commands, business graphics, drawing techniques, custom character sets and animation. *Computer Graphics for the IBM Personal Computer* takes the subject further and deeper, and a section on the representation of three-dimensional solid objects more than compensates for the absence of any discussion of the new commands and extensions made available in Basic version 2.

Microcomputer Graphics for the IBM PC provides a sound introduction to the subject. The style is somewhat dry, but the

(continued on next page)

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many examples and explanatory diagrams present the subject concisely, so this may double as a textbook and a reference work. *Business Graphics for the IBM PC* sets out to teach the theory and calculations necessary to generate flexible business graphics. For those struggling to get such output from their data through Basic programming this book, with about 1,000 lines of example code, may be just the ticket.

IBM PC owners using VisiCalc can now buy a series of step-by-step guides to make business planning a cinch. *Controlling Financial Performance* has been adapted for a U.K. readership: after a short introduction to the computer and to VisiCalc it provides detailed instructions for setting up a profit-and-loss account. Balance sheets, liquidity, gearing and profitability are all explained in easily understood business terms. Corresponding spreadsheet models are provided with automatic recalculation to show how the software is used as a working tool to make What-If? projections. Template spreadsheets are provided for adapting to the reader's own business, and some indicators are given on controlling financial performance.

Planning and Budgeting uses the same techniques to explore cash budget, proforma profit and loss and balance sheet, and forecasting models. *Business Decision Making* covers break-even analysis, overheads, market analysis, pricing, stock control, operations management and cash flow. Like *Controlling Financial Performance,* these books provide sound practical advice to the business user; a disc containing examples and templates is available with each one.

Learning how to program in assembler is an excellent way of becoming familiar with the technical aspects of microprocessor operation. Samuel A Solomon's *IBM PC Assembly Language is Fun and Easy* is the first book I have seen that successfully presents this potentially dry and academic subject in a light-hearted and accessible way. By page 56 six short chapters have covered the bare bones of creating an assembler program: the form of the code, using the editor, assembler and linker, hexadecimal representation, and the testing of a program using the IBM PC's interactive debugger. Subsequent chapters cover logical groups of instructions, put into context by a complete program presented at the end of the book that enables computer memory to be viewed and edited in full screen mode.

Solomon does not attempt to provide a technical reference book, unlike Leo J Scanlon in *8086/88 Assembly Language Programming*. This rewrite removes some of the vagaries of style present in his earlier book; also gone are the direct references to the IBM PC, which seemed to be largely beyond the author's grasp. The book is an adequate catalogue of 8086 assembler aimed at a more experienced reader than Solomon's work, and comes with some examples of code for standard applications like bubble sorts and ordered list processing.

Bik Chung Yeung's *8086/8088 Assembly Language Programming* is based on the author's experience from running a series of assembler courses, and contains some good original material. Although a quarter of his book concerns the Sirius machine and the accompanying Microsoft software — which is similar to that used by IBM — users of other hardware are adequately compensated by the extensive and original examples which include a standard I/O library and a communications program. Like other books reviewed here and put together in Britain, it suffers from poor layout, poor artwork and inferior typesetting design. I doubt that even at a relatively low price, this book will attract the sales that it deserves. PC

IBM PC and XT Owner's Manual by Barbara Lee Chertok et al. Published by Brady/Prentice-Hall International, 200 pages, £17.20. ISBN 0 89303 531 9

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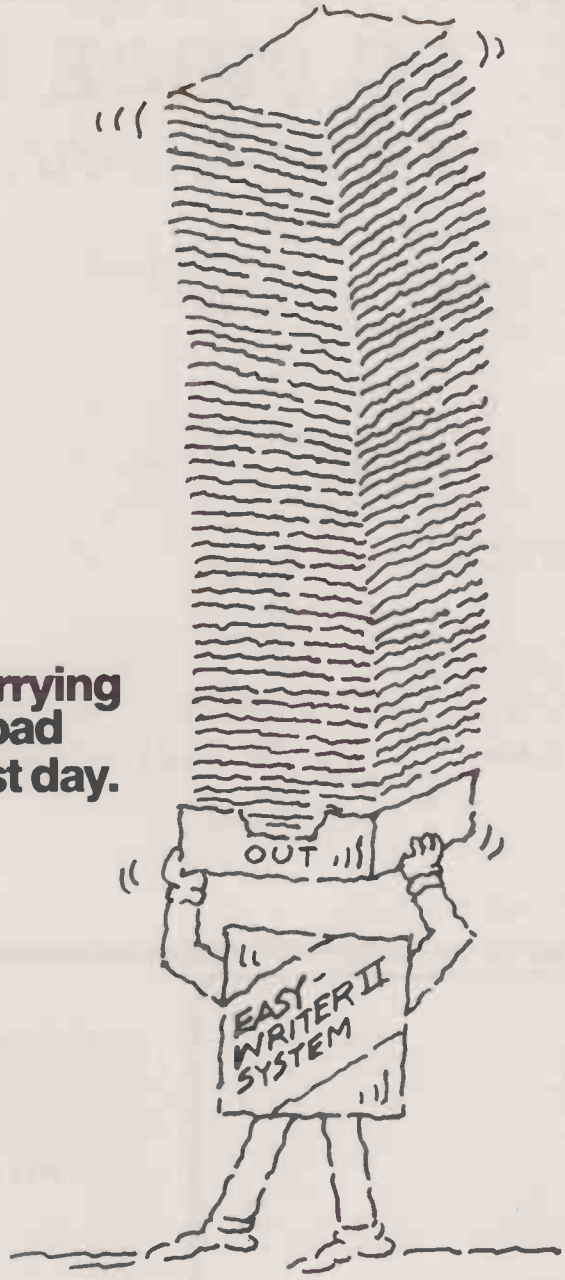
8086/88 Assembly Language Programming by Leo J Scanlon. Published by Brady/Prentice-Hall, 213 pages, £18.35. ISBN 0 89303 424 X

8086/8088 Assembly Language Programming by Bik Chung Yeung. Published by John Wiley, 265 pages, £9.95. ISBN 0 471 90463 5



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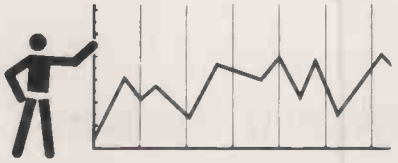

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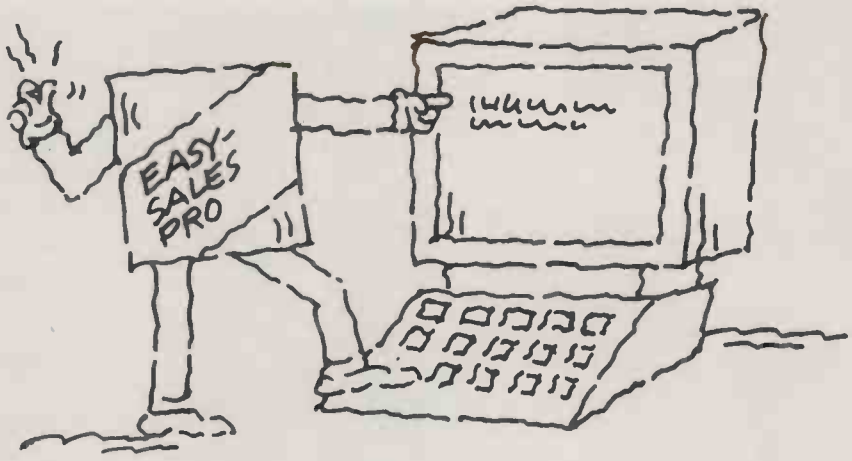

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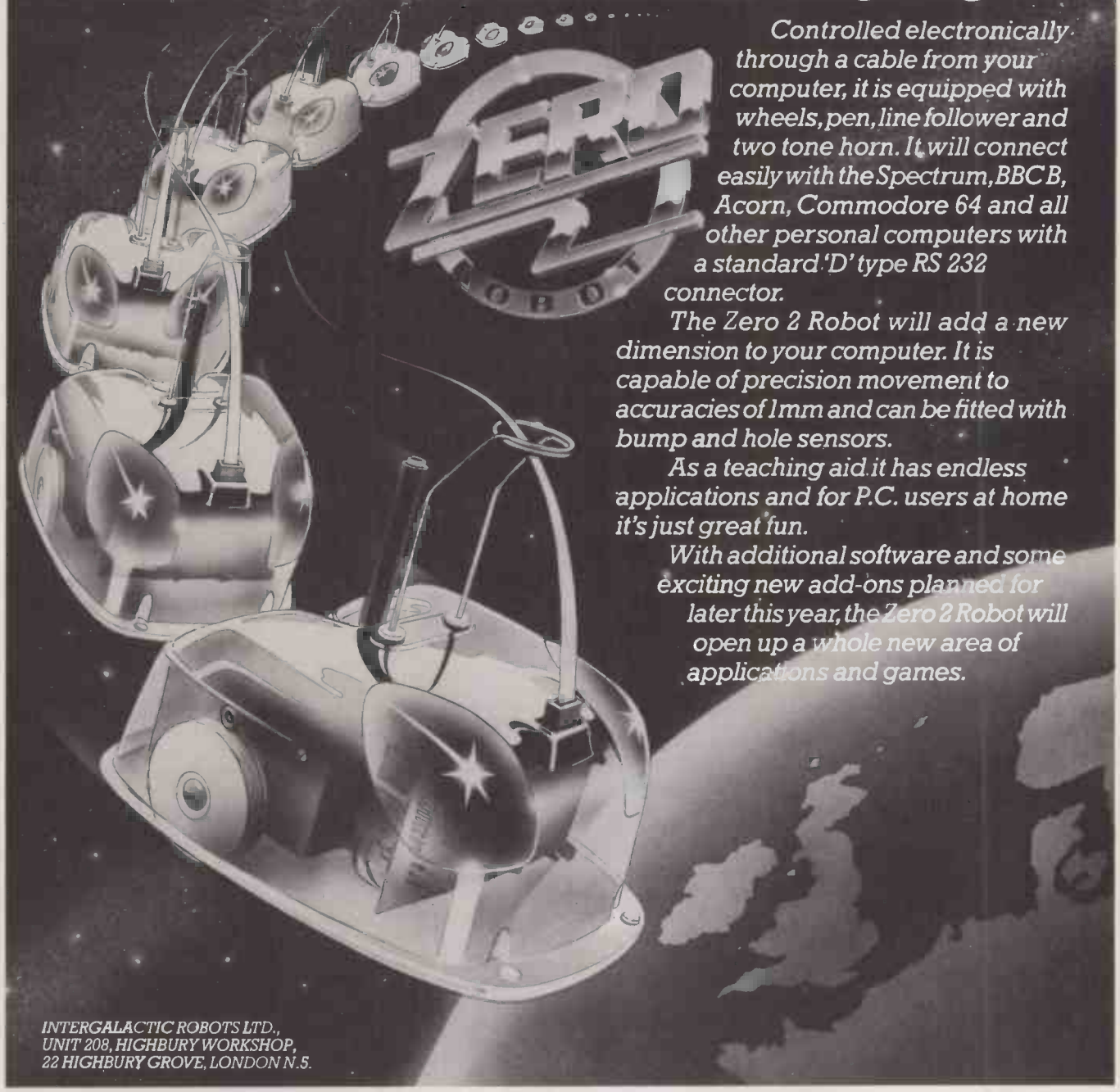

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CAC not CAL

P A S Craddock asserts that those scarce micros in primary schools should be used first and foremost to encourage creativity.

WHEN YOU face a class of 10-year-olds who sit waiting for their group's turn to go to the computer, you realise how inadequate the supply of hardware for schools is. The need for more resources is clear, for with children eager to learn and eager to use computers to help them, one precious afternoon a week computer session is pitifully little.

Computers in primary schools are becoming like old clothes: no novelty but comfortable and well used. Yet interest in computers is still growing. Computers are no longer wonder machines, but a fact of many lives as the number of home computers increases and children become more used to the sort of fare that their machine can offer. However, unless the software offered in schools can be as interesting and compulsive as that used in the home there is a danger of souring the machine educationally in children's eyes.

Three kinds

For the most part, educational software comes in three kinds: drill and practice of specific skills, topic-generating programs and applications software, all of which have their place in the classroom. In addition, there are administrative management programs which are extremely valuable for a school-office computer.

Much rubbish has been written about drill and practice. These programs have been subjected to descriptions such as "soul destroying", "over repetitive" and "of little value". Even the humble drill and practice programs have their place.

Drill and practice using the computer has been, and will continue to be, important in schools. It is often one of the best ways for a child to practise a particular skill, and is often sought by teachers. The computerised work card gives a child a unique opportunity to work at an easy, personal pace, and frees the teacher to employ his or her professional skills elsewhere. It is also a useful type of program to reinforce concepts which have been taught recently. That is not to say there are not serious limitations upon its use, the chief one being that only one or two children at a time may use the computer.

The application program — the content-free utility — has a usefulness all of its own. Much excellent work, especially of an analytical kind, can be carried out using databases. Often this can teach children the limitations of the computer. For example, does its screen-handling facilities allow them to display information easily and sensibly? A computer screen is also a source of many pitfalls; does the machine automatically columnise decimal values, for instance? If children want to use $5\frac{1}{2}$ instead of 5.5, can they? Things of this kind are as useful to the child in a learning situation as the content of the database itself.

Word processing is of similar use. Not only can word processors be used for providing a good display of other work, they can be useful as an aid to confidence if a child has difficulty in getting words on to paper but is otherwise full of ideas.

Utilities can provide many sorts of constructive work, but do not draw particularly heavily on a child's creativity. This is where the other sort of program comes into its own. You can purchase a number of programs which can be used by a teacher to enrich a classroom environment by providing a stimulus that is wide ranging and interesting.

The word "topic" in schools is one that has many meanings to many people. I feel that this is the most exciting area of the curriculum into which the computer has moved, and many good programs already exist of this type. It is certain that more will be becoming available on a variety of machines. Those already in existence include certain of the Dudley Programs such as Spacex, Granny's Garden and Argonaut, all for the BBC model B. Quite a large number of games and adventure programs also fall into this category. The BBC model B and the Spectrum are in the forefront at the moment, but similar programs will be available for the Amstrad and other machines.

Topics made exciting

Such programs provide a teacher with a base for stimulating the imagination of children, and through it their creativity. In primary schools there are endless possibilities in terms of artwork, creative writing and so on. The programs are designed to produce various spin-offs. By using them the child enters the world of computer-assisted creativity, where what is going on in the machine is able to stimulate the essentially human ability to expand the consciousness to take in a whole range of imaginative concepts. Thus, a comparatively brief exposure to a computer can often have a disproportionately useful effect on a child's work and thinking.

The value of this to a teacher is impossible to overestimate, for if children find such a program interesting they will actually want to develop further the ideas offered to them. A typical response to such work is "Could we write our own program like this about. . .", and out comes another area of interest the children may have. Unfortunately it is not usually possible for children to actually write such a piece of code, because the complexity of what goes on deep in the machine escapes them. But it is a slow-thinking teacher who does not pounce on this spontaneous desire to be creative and channels it down other constructive paths. Another likely response is "What if X did Y instead of Z?" If the program itself does not provide an answer, then there is yet another channel for the teacher to encourage the child to explore.

Work and play

Simulation programs which fall within this category are especially useful for exploring all kinds of What-If? situations. Many teachers have used Oil Slick or The Mary Rose to good effect, and a skilful teacher can often get work out of games such as Taipan and Forest Fire that lasts for many weeks before all the possibilities are exhausted. Much of this work goes beyond the factual and into the realm of imagination. It is interesting to see the different levels that a class of children can work on simultaneously with only quite short sessions at the machine itself.

Much educational thinking about computers is that they should be a normal classroom resource. This is a sound idea, but will not come to fruition until a lot more machines are available. The shortage of machines is offset to some degree by programs that only require short exposure to stimulate activity. There is little that can be done to increase the numbers of machines that a school can afford. The government's pound for pound scheme can only provide one machine per school when we should really be thinking of one machine per class, and money gets tighter year by year.

So it is necessary to get the most possible out of a machine, which suggests that the more spin-offs a computer session can generate the better the use to which it is being put. If teachers lean towards computer-assisted creativity — CAC rather than CAL — then the typical single computer session per week might provide sufficient material to last until the next one. PC

P A S Craddock is in charge of Computer Studies at Bluecoat Junior School, Walsall, and a former member of the microelectronics team at Walsall Education Development Centre.

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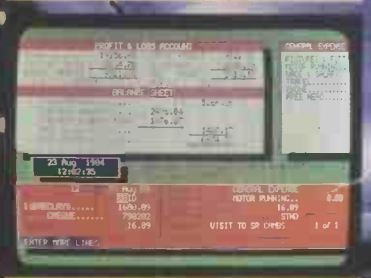
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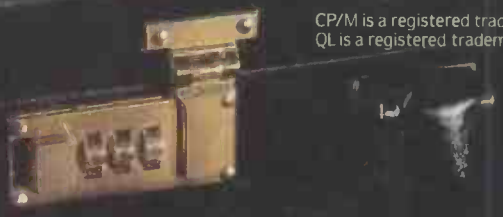

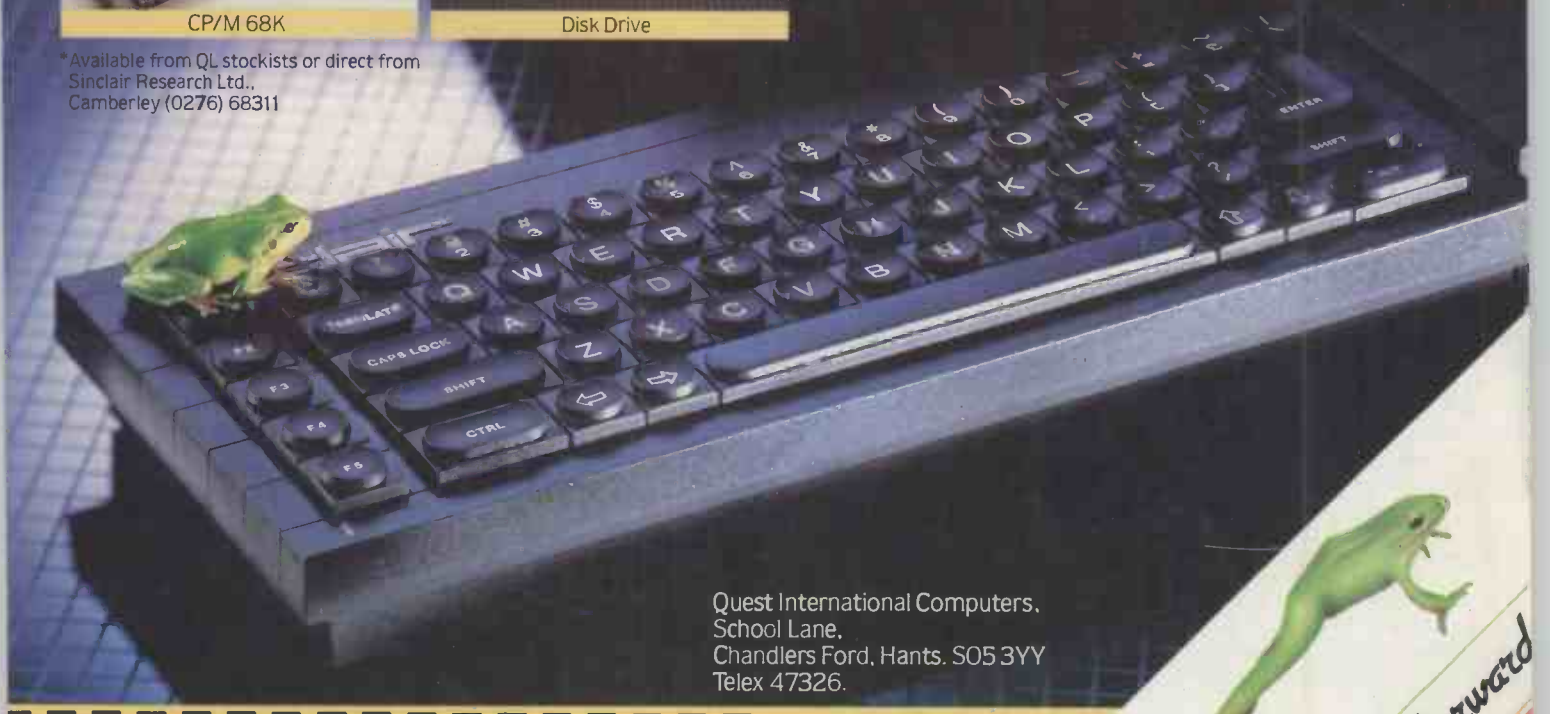

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